DRAFT

HEARD

ENVIRONMENTAL IMPACT STATEMENT

BUREAU OF LAND MANAGEMENT

AUGUST 1982

UINTAH BASIN SYNFUELS DEVELOPMENT

United States Department of the Interior

BUREAU OF LAND MANAGEMENT
UTAH STATE OFFICE
136 E. SOUTH TEMPLE
SALT LAKE CITY, UTAH 84111

IN REPLY REFER TO

1792-UBS
(U-910)

Dear Reviewer:

This draft environmental impact statement (EIS) on the proposed Uintah Basin Synfuels (oil shale and tar sand) projects and alternatives is submitted for your review and comment. The draft EIS contains two types of analysis: 1) a regional assessment of the nine proposed projects, and 2) a site-specific analysis for five of the nine proposed projects and their alternatives. The purpose of this public review is to improve the impact analysis presented in the draft EIS. The final EIS will be prepared considering the comments received.

Comments on the Draft EIS may be submitted in writing or presented verbally at a public hearing. Public hearings have been scheduled for 7:00 pm in the following communities:

September 21, 1982	September 22, 1982	September 23, 1982
Circuit Court Room	Court Room	Salt Palace, Rm 220
Uintah County Courthouse	Rangely Town Hall	Salt Lake City, Utah
147 East Main Street	209 East Main Street	
Vernal, Utah	Rangely, Colorado	

Please address written comments to:

Lloyd Ferguson, District Manager
Bureau of Land Management
170 South 500 East
Vernal, Utah 84078

In order to be considered in the Final EIS, all comments must be received by October 19, 1982.

Please make your comments as specific as possible. Comments will be most helpful if they address the adequacy and accuracy of the impact analysis of the various proposed actions and alternatives.

A copy of the final EIS will be sent to all persons who provide comments on the draft EIS or who request a copy. Requests for copies of either the draft or final EIS should be sent to:

Thom Slater		Lloyd Ferguson, District Manager
Bureau of Land Management		Bureau of Land Management
Utah State Office	or	170 South 500 East
136 East South Temple		Vernal, Utah 84078
Salt Lake City, Utah 84111		

Sincerely yours,

Roland G. Robison

Roland G. Robison
State Director

Enclosure

DEPARTMENT OF THE INTERIOR

DRAFT ENVIRONMENTAL IMPACT STATEMENT

on the

UINTAH BASIN SYNFUELS DEVELOPMENT

Prepared by

Bureau of Land Management

August 1982

Roland G. Robinson

State Director, Utah

COVER SHEET

Uintah Basin Synfuels Development Environmental Impact Statement

(X) Draft ( ) Final

Lead Agency

U.S. Department of the Interior, Bureau of Land Management

Cooperating Agencies

U.S. Department of the Interior
- Bureau of Indian Affairs
- Bureau of Reclamation
- Fish and Wildlife Service
- National Park Service

U.S. Department of Agriculture
- Forest Service

Environmental Protection Agency

U.S. Department of the Army
- Corps of Engineers

Counties and Reservations that Could Be Directly Affected

Utah
- Duchesne
- Uintah
- Grand
- Wasatch
- Summit
- Salt Lake
- Davis

Colorado
- Rio Blanco
- Mesa

Uintah and Ouray Indian Reservation

Abstract

This EIS assesses the environmental impacts of synfuel projects proposed for the Uintah Basin of northeastern Utah. Site-specific impact analyses are presented for five projects, including their alternatives, proposed to begin construction within the next two years. These projects are the Enercor Rainbow Project, Magic Circle Cottonwood Wash Project, Paraho-Ute Project, Syntana-Utah Project, and Tosco Sand Wash Project. This EIS may result in amendments to the Bonanza, Book Cliffs, Hill Creek, and Rainbow Management Framework Plans.

A regional cumulative analysis is also presented. It considers the cumulative impacts of the five site-specific projects, four more conceptual projects (Enercor-Mono Power P.R. Springs Project, Geokinetics Lofreco and Agency Draw Projects, and Sohio Asphalt Ridge Tar Sand Project), plus other interrelated projects planned for development in the Uintah Basin during the analysis period.

Based on the issues and concerns identified during the scoping process, the EIS focuses on the impacts to socioeconomics, water resources, air quality, and wildlife.

EIS Contact
Comments on this EIS should be directed to:

Lloyd Ferguson, District Manager
Bureau of Land Management
170 South 500 East
Vernal, Utah 84078

Date By Which Comments Must Be Received
October 19, 1982

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PREFACE

This environmental impact statement was prepared in compliance with the National Environmental Policy Act (NEPA) of 1969 and in accordance with the Council on Environmental Quality (CEQ) Regulations of 1978. It was prepared in response to applications by seven different companies for various rights-of-way across public land. These rights-of-way would be required in order for the companies to develop oil shale and tar sand reserves they hold under state or private leases. The companies involved are Enercor, Enercor-Mono Power Company, Geokinetics Incorporated, Magic Circle Energy Corporation, Paraho Development Corporation, Sohio Shale Oil Company, Syntana-Utah Corporation, and Tosco Development Corporation. A total of nine separate projects are proposed by these companies. The projects are scheduled to begin construction and operation during 1983 through 1994. Five of the proposed projects (site-specific projects) are scheduled to start construction within the next two years and require immediate decisions on their right-of-way applications. The other projects (conceptual projects) are still in the early planning stages, but will require right-of-way decisions within the next few years.

In order to efficiently and effectively complete the NEPA process for the many right-of-way applications, the environmental impact analyses for each of the proposed projects were conducted simultaneously and are presented together in this EIS. The EIS presents site-specific and cumulative impacts in sufficient detail such that right-of-way decisions can be made immediately for projects analyzed on a site-specific basis. When specific action on the right-of-way application(s) for a conceptually analyzed project is requested, the decision process will be able to proceed quickly, following a supplemental environmental assessment by the Bureau of Land Management Vernal District. Consideration will be given at that time to project design adjustments or additional site-specific impact analysis that may be necessary.

This environmental impact statement is divided into two major parts:

1) Regional Cumulative Analysis
2) Site-Specific Analyses

The regional cumulative analysis provides an overview of the environmental consequences that may result from the development of all the applicants' proposed synfuel projects and interrelated projects planned for the Uintah Basin. The site-specific part includes five site-specific impact analyses--one for each site-specific project. Each analysis examines the possible environmental consequences of implementing a particular site-specific project in isolation from the other proposed synfuel projects. This will enable federal, state, and local decision makers to evaluate the impacts that could occur if any one project were the only one to be developed. This approach also will enable the decision makers to evaluate the impacts that could result from development of any possible combination of the applicants' projects.

Several technical reports have been prepared to support information presented in this environmental impact statement. Detailed technical reports on the air

quality impact analysis, the socioeconomics impact analysis, and the Tosco Salt Lake City Alternative Shale Oil Product Pipeline can be obtained from Mr. Thom Slater, Bureau of Land Management, Utah State Office, 136 East South Temple, Salt Lake City, Utah 84111 or from Mr. Dave Moore, Bureau of Land Management, Vernal District, 170 South 500 East, Vernal, Utah 84078.

A project description technical report that describes a particular site-specific or conceptual project in more detail can be obtained from the following companies:

Enercor Rainbow Project	Mr. Kent Hatfield Enercor American Plaza II Suite 500 57 West 200 South Salt Lake City, Utah 84101
Enercor-Mono Power P.R. Springs Project	Mr. Mike San Miguel Mono Power Southern California Edion 2244 Walnut Grove Avenue Rosemead, California 91770
Magic Circle Cottonwood Wash Project	Mr. Reed Clayson Synfuels Engineering and Development P.O. Box 5147 Golden, Colorado 80401
Paraho-Ute Project	Mr. Bob Heistand Paraho Development Corporation 300 Enterprise Building Grand Junction, Colorado 81501
Syntana-Utah Project	Mr. Robert Lee Syntana-Utah 601 Jefferson 40th Floor Houston, Texas 77002
Tosco Sand Wash Project	Mr. John Hardaway Tosco Development Corporation 11100 East Bethany Drive P.O. Box 441464 Aurora, Colorado 80014-1439

The Uintah Basin has a large potential for development of oil shale and tar sand resources. Additionally, the basin has a wide variety of other resources and human activities that would be affected by oil shale and tar sand (synfuels) development.

The synfuels development would cause impacts either by displacing resources (such as removal of vegetation), using resources (such as water consumption), or creating other changed conditions (such as visual scars or community growth). The analysis of synfuels development in the Uintah Basin focuses on these kinds of potential impacts from nine proposed projects. If developed, these projects would use only a small portion of the oil shale and tar sand reserves in the Uintah Basin; however, the impacts from such development would result in a marked change in the character of the basin for a 35-year period or longer.

ANALYSIS CONCLUSIONS

The analysis indicates that, in general, each project by itself would have impacts of a nature and magnitude that could be managed without undue degradation to other natural resources or to socioeconomic conditions. Mitigation measures are identified to minimize impacts to resources and/or to provide restoration. Even so, individual projects would cause impacts, and these are noted in this environmental impact statement (EIS).

A question posed early in the analysis process raised concern about the potential for a "threshold level" where multiple development of projects could be limited by resource constraints (such as possible air quality standard violations, or lack of water availability). The regional cumulative analysis of all nine synfuels projects included in this EIS indicates that, in general, all of the projects could be pursued without reaching such a constraint level provided that mitigating measures would be incorporated to avoid "worst-case" conditions. This would be true for a synfuel production scenario of 248,400 barrels per day (low-level) and a production scenario of 444,053 barrels per day (high-level), considering the nine proposed projects and interrelated projects.

The analysis suggests that the most challenging consequence of the development of the synfuels projects would be the need for orderly management of population growth and its attendant factors. With all nine projects and the interrelated projects, the Uintah Basin population is projected to increase to as much as 151,739 by 1995, or about two and one-half times its present number. This could create problems of substantial magnitude for local city and county governments, as well as for the Ute Indian Tribal Council. To meet this challenge would necessitate a cooperative effort by the synfuels project developers, the governing entities, and the majority of the citizens involved.

Related to this, the analysis shows that significant transportation problems may result, particularly due to large increases in vehicular traffic. Such traffic increases would in turn generate a need for major public road improvements.

RESOURCE COMMITMENTS

Uintah Basin resources would be used through the development of the proposed projects. It is possible to quantify the amounts of these resources that would be directly committed to use by construction and operation of the projects. However, the amounts of resources that would be indirectly committed to use by the projects due to such things as project-related population growth (secondary impacts) are difficult to quantify. The amounts of indirectly committed resources that would be used could be substantial, and the effects of these commitments could have effects equal to or greater than the direct commitments, which have been quantified.

Air quality degradation would occur across the Uintah Basin. Direct emissions resulting from the nine synfuel projects included in this EIS would be within the present limitations of regulated pollutants. Secondary emissions of total suspended particulates resulting from population growth and related activities could exceed both Prevention of Significant Deterioration (PSD) and national ambient air quality standards (NAAQS). The NAAQS standards for total suspended particulates are already exceeded in many areas throughout the region (largely as a result of wind-blown dust) and these levels would be significantly aggrevated by synfuel development. In addition, if the fugitive dust from secondary sources were to be included in the consumption of PSD increments for total suspended particulates, and mitigation measures such as paving or chemical stabilization of roadways were not employed, it is quite likely that PSD Class II increments for total suspended particulates would be exceeded in much of the region.

The Dinosaur and Colorado National Monuments are currently federal Class II areas that are under consideration for redesignation to Class I. These areas are also Colorado Category I for sulfur dioxide. It is possible that PSD Class I and Colorado Category I increments could be exceeded in these two areas.

Significant, local reductions in visual range could be observed in stagnant haze layers principally in the winter. These hazes would be caused by total suspended particulates emissions from industrial facilities, windblown dust, dust from roadways, and smoke from residential wood stoves and fireplaces. These hazes would be infrequent and localized and would not affect regional visibility and views in wilderness areas. Worst-case reductions in regional visual range (10 percent or less) are anticipated to occur in the summer when sulfate formation rates are highest. The predicted high total suspended particulates concentrations from secondary emissions are not expected to greatly reduce regional visibility but would cause local dust clouds. Yellow-brown atmospheric plume discoloration could be visible (on fewer than 50 days), primarily on mornings with clear, light-wind, stable conditions in the vicinity of synthetic fuel facilities, on the Uintah and Ouray Indian Reservation and at Dinosaur National Monument.

For the nine projects under the high-level production scenario, water would be utilized at the rate of about 36,000 acre-feet per year from the White River and about 32,000 acre-feet per year from the Green River. A total depletion of 132,000 acre-feet per year would be anticipated from the proposed projects, interrelated projects, and their associated population increases. This total depletion would result in an average salinity increase, for the years 1983 to 2000, of 5 mg/l at Imperial Dam, California.

With the development of the nine projects, vegetation and the underlying soil would be disturbed on 36,911 acres. An additional acreage could be disturbed from secondary activities. Agricultural lands would be reduced by secondary impacts from the nine projects through conversion of 14,930 acres of cropland to urban use for community growth as home sites and commercial developments, which would further influence the change of the area's economy from limited agriculture to industry. Forage losses at the project sites could cause a reduction in livestock numbers on the range. Secondary impacts from increased traffic and construction activity could cause additional loss of forage and disruption of grazing patterns.

Vegetation losses would decrease habitat for animals, which would result in a reduction in numbers of wild animals. Secondary impacts from the projected increase in population would increase poaching of animals by an estimated 15 percent.

Recreation opportunities for hunting would be decreased through loss of animals and increase in numbers of hunters. Camping experiences and other day use recreation activities would be affected by competition for available sites or crowded conditions. Municipal recreation facilities and city park areas likely would become overcrowded and overused, causing declines in user satisfaction.

Federally classified threatened and endangered fish in the White River and/or Green River could be affected by a decrease in flow and an increase in salinity. Fish conservation measures could be required to offset impact.

Endangered plant species could be affected by the greater numbers of people seeking recreation opportunities who may inadvertantly destroy the plants through off-road vehicle use.

Wilderness characteristics in portions of one potential wilderness area could be impaired by construction activities. Characteristics in two potential wilderness areas could be impaired by the greater numbers of people who would be visiting them.

Cultural resources could be lost through destruction of undetected sites during project construction. Significant cultural resources that could not be avoided or mitigated would be lost. Similarly, some paleontological resources would be destroyed. Other undetected sites, cultural resources, and paleontological resources could be destroyed through unauthorized, random collection of artifacts by individuals and by vandalism.

Visual values would change from the naturally appearing landscape to a highly modified landscape with primary changes in vegetation patterns and the introduction of structures to the regional landscape.

UNRESOLVED ISSUES

During EIS preparation, several issues were identified that would be subject to further discussion, coordination, and action. For the most part, these issues would need to be pursued outside of and independent from the EIS process if a resolution were to be attained. The unresolved issues are noted here for further consideration by those involved.

The issues are related to air quality, water supply, and several facets of socioeconomics. Additionally, there is a general uncertainty regarding national prospects for synfuels production.

AIR QUALITY

There is a concern related to interstate air pollution control and the potential allocation of the available air increment should all the applicants' proposed projects be developed. There is the potential that the proposed synfuels development in Utah could violate the Colorado Category I increment. This issue would have to be resolved by the respective states. There is also concern on the part of the Ute Indian Tribe that the use of the air increment by the proposed synfuels projects could limit future developments on the reservation.

WATER SUPPLY

A number of unresolved issues remain regarding the use of White River or Green River water for synfuels development. Even though it was assumed in this EIS that the White River Dam would be constructed, uncertainty still exists as to if and when that project would be developed. Also, the amount of White River water that could be made available for synfuels development, regardless of whether the dam would be constructed, is unknown for several reasons. A proposed water compact between the State of Utah and the Ute Indian Tribe has not been ratified by the Tribe. The Ute Indians, under the Winters Doctrine, are entitled to irrigate up to 12,833 acres of land within the reservation, with water diverted from the White River. In addition, the amount available depends on future upstream water development primarily in Colorado.

Green River water could be used through the purchase of water from the Flaming Gorge Reservoir. According to the U.S. Bureau of Reclamation, water is available from the Flaming Gorge Reservoir for beneficial consumptive uses. However, contracts for the sale of this water would require the approval of the Utah Division of Water Rights (State Engineer) and the Secretary of the Interior. Other institutional requirements would also have to be met. However, it is the opinion of the Utah Division of Water Rights (State Engineer), that water may not be available from the Flaming Gorge Reservoir. This is due to commitments of water for the Central Utah Project and water that would be withdrawn from the Green River to supply the Indian lands on the Leland Bench Project (Utah Division of Water Rights 1981).

SOCIOECONOMICS

Three aspects of socioeconomics are unresolved: (1) the extent to which impacts may be offset as a result of the actions under Utah Senate Bill 170, (2) further analysis desired by the Ute Indian Tribe and the extent to which the tribe may obtain mitigation to offset socioeconomic impacts, and (3) the measures which may be taken to overcome a potential imbalance of tax revenues and impacts as a result of city, county, and state boundaries.

Utah law (Section 63-51-2, Utah Code Annotated 1953, as amended) requires that developers of major projects provide socioeconomic mitigation in the form of prepayment of taxes and other advance funding arrangements. This would be done through a process of mitigation plan preparation and approval, involving project developer representatives, state agency representatives, and local government officials. The plan would identify the cost of providing socioeconomic services necessitated by each major project, and it would contain strategies to pay for the mitigation program.

The developers of major projects (both under construction and proposed in this EIS) have formed the Uintah Natural Resources Association Inc. to discuss and explore socioeconomic impact mitigation arrangements. These arrangements are, as yet, undetermined. When the mitigation plans are prepared and approved, and the results known, some of the issues or potential impacts identified in this EIS may then be resolved.

The Ute Indian Tribe and the Bureau of Indian Affairs have requested a "comprehensional data collection program of primary and secondary data." Such a program would be intended to "establish a data base for further studies on this (Uintah and Ouray Indian Reservation) reservation" and "...would lend itself to multiple uses for other energy-related development..." (BIA 1982). Additional information on impacts to the Ute Indian Tribe is expected to be obtained and included in the final EIS.

Additionally, Utah Senate Bill 170 does not cover socioeconomic mitigation for potential socioeconomics impacts to the Ute Tribe because of the tribes' separate and distinct governmental status. Socioeconomics mitigation may be negotiated between the tribe and each project developer; however, such arrangements are at present uncertain and are considered to be an unresolved issue.

There is a potential imbalance of property tax revenues to be derived from the applicants' projects and the expenditures to provide services for the project induced population. This imbalance is of most concern between Uintah and Duchesne counties, Utah; and between Utah and Colorado (specifically the communities of Dinosaur and Rangely).

LAND USE ARRANGEMENTS

Two aspects of land use are of continuing interest: potential for land exchanges and pipeline corridor considerations.

Potential Land Exchanges

Several applicants have proposed or are contemplating land and/or oil shale resource exchanges to consolidate (block up) project mining areas. This would involve the trading of state and BLM land, providing that acceptable lands and values are involved, followed by a state lease to the particular project developers. Discussions of such exchange possibilities are underway between the project developer, the Utah State Land Board, the Vernal District BLM, and the U.S. Minerals Management Service. The site-specific section of this EIS identifies potential exchange areas desired to be obtained by three applicants (Magic Circle, Syntana-Utah, and Tosco); however, no determination has yet been made with regard to the acceptablity of the offerred state lands and/or shale resources, or their respective economic values. The BLM Vernal District will prepare an environmental assessment (EA) for each of these three potential exchanges, as well as for those which may be requested in the future for the other projects. Those assessments will supplement this EIS prior to consummation of any particular exchange. BLM decisions regarding land and/or oil shale resource exchanges would be made separate from decisions on the rights-of-ways associated with the proposed projects.

Pipeline Corridor Considerations

The Salt Lake City and County Planning and Zoning Commissions, along with the Uinta and Wasatch-Cache National Forests, have expressed a concern about the potential number of product pipelines that could ultimately extend to Salt Lake City from Uintah Basin oil shale development. A common denominator around which concerns focus is the extremely limited number of available or potential corridors and their conveyance capacity. Mountain passes and Wasatch Front canyons are limited and becoming increasingly congested with development. Concern has been expressed that new pipelines be planned with long-range considerations included to make fully effective and acceptable use of the limited corridor locations and opportunities.

Future oil shale development potential likely could involve considerable transport of shale oil to western processing and market locations. There are a number of potential project developers that could ultimately require product transport. A common carrier design (one large pipeline conveying compatible products, and/or jointly operated multiple pipelines in a fully utilized but limited right-of-way) would be preferred by local, state, and federal agencies and governing groups.

Studies dealing with potential and available corridors have been conducted and are available from local, state, and federal agencies. All the plans presently indicate that extremely limited corridor opportunities and capacity are available.

SYNFUELS UNCERTAINTIES

Synfuels development in the Uintah Basin is influenced by many complex factors, some of which are beyond the control of project developers or agencies with authorizing actions. These factors include (1) national policies concerning synfuels as related to other energy alternatives; (2) the availability of federal assistance through price supports, loan guarantees, or

funding grants; (3) the priorities followed by the Synfuels Corporation concerning oil shale and tar sand as compared to other types of synfuels projects; (4) the availability of money in the private sector and the interest shown by large financial organizations; (5) the international price of oil; and (6) the extent to which energy conservation programs are effective.

These factors result in a degree of uncertainty which could very likely continue indefinitely. Since the proposed synfuels projects would involve a relatively long construction time and a 20- to 35-year commitment of large expenditures, the uncertainty would have a strong influence on decisions by the project developers regarding the future scheduling, construction, and size of the proposed projects. Schedules and project dates shown in the EIS represent the applicants' current objectives but may be revised as influenced by future events.

This uncertainty also makes it difficult for local governments and other to plan services to meet the needs of project-related growth.

BLM-PREFERRED ALTERNATIVES

The selection of the BLM-preferred alternatives is based on the information contained in the Draft EIS as well as coordination with the public and other agencies. Further coordination and comments received on the Draft EIS will be considered in the final determination of the BLM-preferred actions as part of the Final EIS.

Based on the impact analysis of the high-level scenario, it was determined that the impacts due to the development of all the applicants' proposed projects would be manageable, assuming implementation of specific mitigation measures, compliance with existing regulations, and implementation of suitable socioeconomic impact agreements. Therefore, BLM proposes to approve the rights-of-way necessary to implement all of the site-specific projects. However, as identified below, the rights-of-way BLM proposes to approve are not necessarily those preferred by the applicants.

Enercor Rainbow Project -- the proposed action with the White River Section 12, Range 24 East Alternative Water Supply System and the Paraho Tie Alternative Power Transmission Line.

Magic Circle Cottonwood Wash Project -- the proposed action with the White River Alternative Water Supply System.

Paraho-Ute Project -- the proposed action.

Syntana-Utah Project -- the proposed action with the Mormon Gap Alternative Natural Gas Pipeline.

Tosco Sand Wash Project -- the proposed action with the Alternative Access Roads, White River Section 17 Alternative Water Supply System, North Route Alternative Power

Transmission Line, and either the proposed action product pipeline or the Salt Lake City Alternative Product Pipeline.

BLM would defer decisions on the conceptually analyzed projects until a later date. However, assuming no environmentally adverse project design changes and the location of the rights-of-way within the proposed BLM planning corridors, BLM anticipates that when specific action on the rights-of-way applications for the Enercor-Mono Power P.R. Springs Project, Geokinetics Agency Draw and Lofreco Projects, and Sohio Asphalt Ridge Project are submitted, subsequent site-specific environmental assessments would lead to approval of the necessary rights-of-way.

RELATIONSHIP TO UINTAH AND OURAY INDIAN RESERVATION

The Uintah and Ouray Indian Reservation lies within Uintah, Duchesne, Wasatch and Grand counties, Utah, within the western part of the Uintah Basin. Some of the proposed synfuels projects could directly affect the reservation through the development of pipelines, power transmission lines, and access roads; however, most project facilities would not be located on the reservation. Even so, the proposed synfuels development in the Uintah Basin would influence the reservation.

The reservation is a separate and distinct governmental entity, with specific jurisdictional responsibilities administered by the Ute Indian Tribal Council. It contains Indian tribal lands and Indian-allotted lands, as well as private lands; and both Indians and non-Indians live within the reservation boundaries.

In order to clearly present information pertaining to the reservation (and in particular to the Indian land and the Ute Indian Tribe), specific narrative is included in this EIS under each resource category of major impact concern. These categories are socioeconomics, air quality, water resources, agriculture, recreation, transportation networks, visual resources, and existing land use plans. For the other resource categories, information pertaining to the reservation and/or the Ute Indian Tribe is combined with the other material presented.

R-1.A **OVERVIEW**

The Uintah Basin Synfuels (UBS) Development Environmental Impact Statement (EIS) is divided into two major parts--Regional Cumulative Analysis and Site-Specific Analyses. This part examines the total combined impacts that may result from implementation of all the applicants' proposed synfuels projects (nine projects) and the cumulative impacts of the applicants' projects plus the interrelated projects planned for the Uintah Basin and nearby Colorado areas. Thus, this part is entitled Regional Cumulative Analysis.

The purpose of this part of the EIS is to present the cumulative impact analysis for the applicants' proposed projects that is required by Council on Environmental Quality regulations. Normally, individual EISs would be prepared for each of the proposed projects, with each one containing a cumulative analysis. In this case, all of the proposed projects were combined into one EIS and one regional cumulative analysis was prepared. Therefore, this part does not address alternatives to proposed projects. Alternatives for each site-specific project are analyzed in the site-specific part of this EIS.

A summary description of the applicants' proposed projects is presented in Table R-1-1. The locations are shown on Map R-A-1 (located in Appendix R-A). Detailed descriptions of the five site-specific projects (those scheduled to begin construction within 2 years) may be found in the site-specific part of this EIS. Brief descriptions of the four conceptual projects (those which are still in the early planning stages) may be found in Appendices R-B, R-C, and R-D.

The EIS study area has been defined generally as the area where the facilities of the applicants' proposed projects would be located. As shown on Map R-1-1, this area extends to Vernal, Utah, on the north; Roosevelt, Utah, on the west; Interstate Highway 70 on the south; and Rangely, Colorado, on the east. The area includes the southeastern part of the Uintah and Ouray Indian Reservation. The land status and ownership of the area is shown on Map R-A-3 (located in Appendix R-A). It should be noted that the impact analysis is not restricted to the study area; impacts are traced and identified to the extent possible wherever they would occur within the area influenced by the applicants' proposed projects. The area of influence varies in size, depending on the resource being considered.

The impact analysis focuses on significant impacts to socioeconomcs, air quality, water resources, and wildlife. These are the major areas of concern identified with the help of the public during the EIS scoping process. A summary of the consultation and coordination program used in developing this EIS, including the results of the public scoping meetings, is presented in Appendix R-E.

TABLE R-1-1

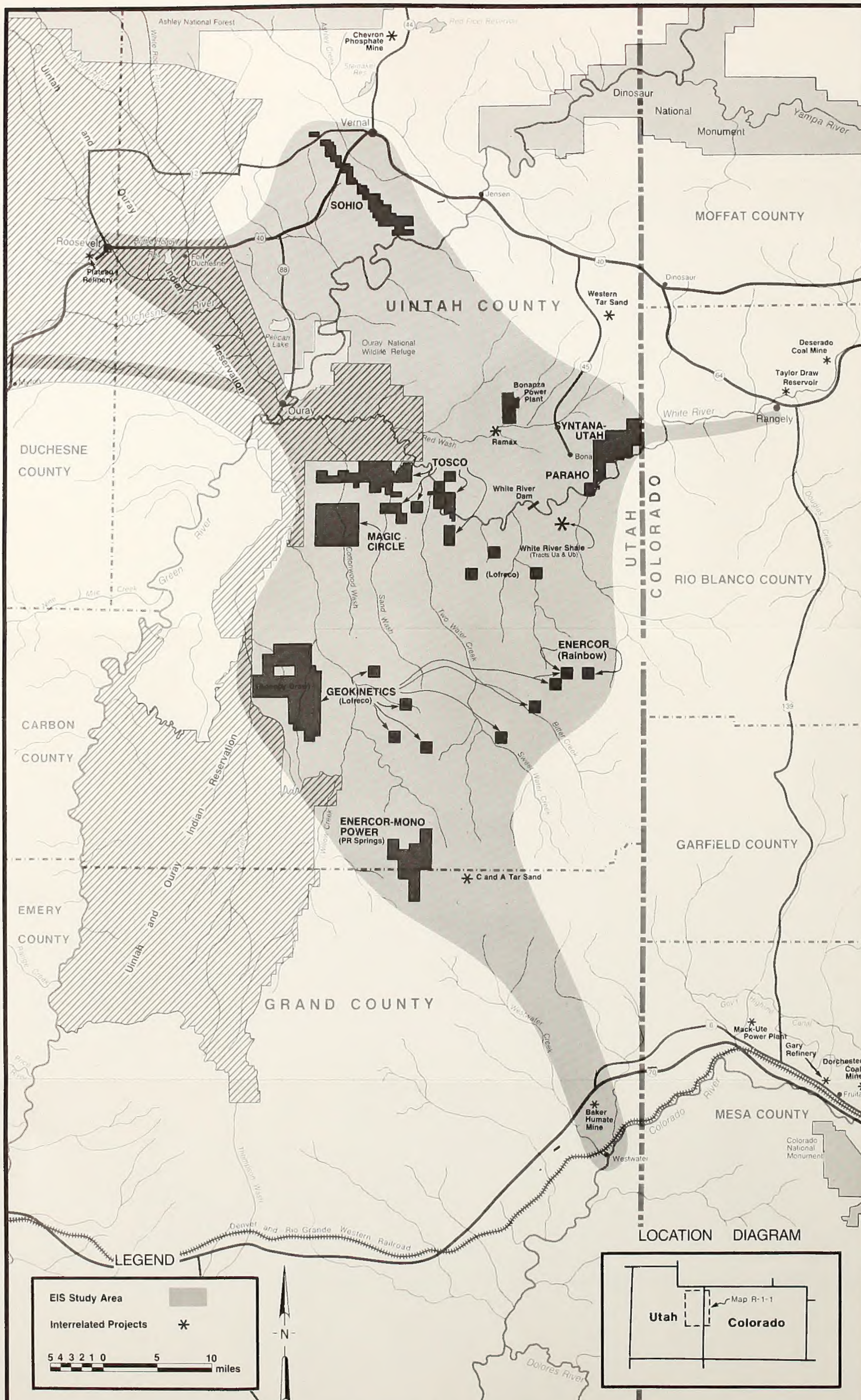
SUMMARY OF APPLICANTS' PROPOSED PROJECTS

Project Name	Project Type	Mine Type	Water Source	Power Source	Process Type	Upgrading	Product Transportation	Anticipated Full Production Date/ Project Life[c]
Enercor (Rainbow)[a]	Tar Sand	Open Pit	White River	Bonanza Power Plant	Hot Water	Delayed Coking	Truck	1985/20 years
Enercor-Mono Power (P.R. Springs)[b]	Tar Sand	Open Pit	White River	Bonanza Power Plant	Hot Water	Delayed Coking	Pipeline to Railhead near Westwater, UT	1990/20 years
Magic Circle (Cottonwood Wash)[a]	Oil Shale	Underground Room & Pillar	Green River	On-Site	Improved NTU/ T3	Water Removal Only	Pipelines to Roosevelt, Chevron Pipe-line, and Gary Refinery Pipe-line (at Bonanza)	1988/30 years
Paraho (Paraho-Ute)[a]	Oil Shale	Underground Room & Pillar	White River	On-Site (at full production)	Paraho Direct Heat	Natural Gas Hydrotreating	Pipeline to Chevron Pipeline	1987/10 years
Syntana-Utah[a]	Oil Shale	Underground Room & Pillar	White River	Bonanza Power Plant	Superior and TOSCO	Natural Gas Hydrotreating	Pipeline to Rangely	1994/30 years
Tosco (Sand Wash)[a]	Oil Shale	Underground Room & Pillar	White River	Bonanza Power Plant	TOSCO	Fractionation Hydrotreating	Pipeline to Rangely	1989/35 years
Geokinetics (Agency Draw)[b]	Oil Shale	Underground Room & Pillar Secondary, In-situ	Green River	On-Site	TOSCO	Unknown	Pipeline to Roosevelt	1987/30 years
(Lofreco)[b]	Oil Shale	In-situ	None	Bonanza Power Plant	In-situ	Unknown	Truck to Agency Draw	1994/20 years
Sohio Shale Oil (Asphalt Ridge)[b]	Tar Sand	Open Pit	Green River	Utah Power and Light	Counter-cur-rent Solvent Extraction	Delayed Coking and Hydro-treating	Pipeline to Salt Lake City or Midwest U.S.	1989/20 years

[a]Site-specific projects analyzed in detail in the second part of this EIS.

[b]Projects proposed for later development which are analyzed conceptually in this EIS; see Appendices R-B, R-C, and R-D for a brief description of each.

[c]Project life based on current reserves under lease. Life of some projects may be extended with future aquisition of additional reserves.



MAP R-1-1 EIS STUDY AREA

The interrelated projects considered in the regional cumulative analysis are identified and briefly described on Tables R-1-2 and R-1-3. They are projects proposed or planned for development within or adjacent to the study area during the same time period as the applicants' proposed projects. The impact of these projects and the applicants' projects would be related; they would overlap in time and space, and when considered together, could be more significant than when considered in isolation.

The White River Shale Project is considered as an interrelated project because it was analyzed in the Oil Shale Prototype EIS (BLM 1973) and subsequently approved for development. Construction is starting in 1982. The White River Dam Project is also considered as an interrelated project. Although this project has not been fully approved to date (August 1982) by all the authorizing agencies (BLM 1982b), the impact analyses have presumed it will be constructed based on the fact that it has been recommended for approval by the State of Utah.

A regional cumulative impact analysis is presented for a high- and low-level production scenario. For each scenario, the total combined impacts of the applicants' proposed projects and the cumulative impacts of the applicants' projects plus the interrelated projects are identified at two points in time--the year when the applicants' combined construction work forces would peak and the year when the operation work forces would peak. The parameters of the two production scenarios are discussed in the following sections of this chapter.

R-1.B **HIGH-LEVEL SCENARIO**

The high-level scenario assumes all the applicants' proposed projects would be implemented as proposed (Table R-1-1). Under this scenario, the maximum production level of 319,053 barrels per stream day (bpsd) of synfuel would be reached by the applicants' projects by 1995 (Table R-1-4). (See the General Oil Shale Mining, Processing, and Upgrading Techniques section of the Site-Specific Analyses Introduction for an explanation of the concept of stream day.) Considering the interrelated projects as well as the applicants', a maximum of 444,053 bpsd would be produced in the Uintah Basin in Utah. The work force increase predicted for the study area due to this level of development is shown on Table R-1-5. The combined applicants' construction work force would peak in 1985; the operation work force would peak in 1995. The peak work force levels for each applicant's project are shown on Table R-1-6.

As shown on Table R-1-7, construction of the applicants' proposed projects would disturb 36,911 acres of vegetation; 29,572 of these would be reclaimed. The remaining 7,339 acres would be occupied by surface facilities such as buildings and roads, so the land use of these acres would be changed for the life of the applicants' projects. Considering the interrelated projects plus the applicants' projects, a total of 52,631 acres of vegetation would be disturbed, 41,321 acres would be reclaimed, and 11,310 acres would be occupied by surface facilities.

TABLE R-1-2

UTAH INTERRELATED PROJECTS

Project	Project Description	Location	Peak Construction Period (Work force)	Peak Operation Period (Work force)	Operation Water Requirements	Acres Required
Baker Associates, Incorporated-Humate Mine	Applied to BLM for contract sale for 1.12 million tons of humate material. Humate, used as soil conditioner, would be surface mined from a 200-acre area and shipped by rail to Hawthorne, Nevada. BLM has prepared a draft environmental asessment on proposal.	65 miles east along I-70 from Green River; 3 miles from Harley Dome; and 5 miles west of the Utah-Colorado state line, Grand County	Early 1982-1986 (10)	1982-1986 (10)	0	200 acres
Central Utah Project (CUP)[a]	U.S. Bureau of Reclamation plans to construct several elements of CUP including Uintah Unit in Eastern Duchesne County; Jensen Unit; Vernal Unit; improvements to water systems in Roosevelt, western Uintah County and Vernal areas; Upalco Unit; portions of the Strawberry Aqueduct and Collection System; and Duchesne River Canal Rehabilitation Project.	Duchesne and Uintah counties	1985 (855)	1986 (12)	Varies between 11,900 ac-ft/yr and 166,000 ac-ft/yr	7,000 acres required for reservoirs, roads, and other project related facilities
Chevron Resources Company-Vernal Phosphate Rock Operation	Proposes doubling production of mining phosphate on private land.	11 miles north of Vernal	1982-1985 (25)	1985 (25)	3,000 ac-ft/yr Ground water	920 acres in addition to what is being strip mined
Plateau Refinery	Proposes to expand current oil refinery operations from 8,500 bpsd to an additional 10,000-20,000 bpsd; Company has applied for funding from Synthetic Fuels Corporation for refinery expansion.	Western Roosevelt	1984-1985 (unknown)	1985 (unknown)	Insignificant	Insignificant
Ramex	Currently testing in-situ gasification process to develop permanent plant site south of Bonanza Power Plant to possibly sell gas to Deseret Generation and Transmission Cooperative for Unit 2, or possibly tie into existing gas pipelines.	27 miles south of Fruitland, Duchesne County and 1 mile south of the Bonanza Power Plant in Uintah County	1982-1983 for site south of Bonanza Power Plant (50)	1983 (50)	0	640 acres
Western Tar Sand Incorporated	Developing pilot demonstration tar sand plant which would produce approximately 30 bpsd, followed by commercial plant which would produce 1,000 to 5,000 bpsd.	40 miles southeast of Vernal, on Raven Ridge	Pilot plant-- 1982 (unknown) Commercial plant-- 1985-1986 (50)	Pilot plant-- 1987 (unknown) Commercial plant-- unknown (7)	200 ac-ft/yr from the Green River	640 acres strip mine
White River Shale Project	Two federal prototype oil shale lease tracts (U-a and U-b) totalling 10,280 acres. Full commercial operation would entail production capacity of 100,000 bpsd with the tracts estimated to have recoverable reserves of over 700 million barrels of oil.	6 miles south of Bonanza in Uintah County	1988 (4,037)	1994 (3,353)	27,500 ac-ft/yr from the White River	2,575 acres required for mine and spent shale area
White River Dam Project	Utah Division of Water Resources proposes 109,250 ac-ft reservoir on White River to supply water primarily for energy development. A 13.5-mi reservoir would affect 3,560 acres of land. Also proposed are 5 to 8 MW hydroelectric plant, power transmission line, recreation facilities, and access roads. A final EIS was completed by BLM in May 1982.	5 miles south of Bonanza, in Uintah County	1982-1983 (94)	1986 (5)	70,700 ac-ft (active) 38,550 ac-ft (inactive) 109,250 ac-ft (total)	3,560 acres

TABLE R-1-2 (Concluded)

UTAH INTERRELATED PROJECTS

Project	Project Description	Location	Peak Construction Period (Work force)	Peak Operation Period (Work force)	Operation Water Requirements	Acres Required
Bonanza Power Plant Project (Unit 2)[b]	Deseret Generation and Transmission Cooperative proposes two 400-mW coal-fired generators. Approximately 21,720 ac-ft/yr of water would be piped from Green River. Approximately 1,840 acres needed for plant site development. FEIS completed, April 1981.	3 miles northwest of Bonanza, Uintah County	1984 (1,021)	1986 (200)	21,720 ac-ft/yr from the Green River	1,840 acres for the plant site; 2,094 acres for power transmission line right-of-way
Gary Energy Corporation	Proposes to construct 186-miles long, 16-inch diameter crude oil pipeline. Initial carrying capacity would be 95,000 bpsd with full capacity of 95,000 bpsd. Application currently in suspension file per applicant's request. Referred to as Grand Valley Pipeline Project.	Lisbon Station, Utah, to Moab, Utah, to I-70, then north to Rangely, Colorado	Late 1981-mid-1982 prior to suspension of application (unknown)	Mid-1982 (unknown)	Insignificant	1,127 acres
C and A Tar Sand	Mineral Research Limited Company proposes to construct in Phase I a commercial demonstration plant in the P.R. Springs area to produce approximately 200 bpsd from tar sand. Phase II, commercial operation stage, would produce approximately 20,000 bpsd.	P.R. Springs area, 30 miles north of I-70	Late 1982 for Phase I, demonstration plant (25-35) 1984-1987 Phase II, commercial generation plant (200-300)	Phase I--late 1982 (unknown) Phase II--1987-1988 (500-550)	800 ac-ft/yr from the Green River	2,116 acres for strip mine and plant site

[a]Portions of this project are already under construction, and, therefore, are included in baseline projections. Only those units planned for future construction are considered as interrelated projects.

[b]Unit 1 is under construction, and, therefore, is included in baseline projections.

TABLE R-1-3

COLORADO INTERRELATED PROJECTS

Project	Project Description	Location	Peak Construction Period (Work Force)	Peak Operation Period (Work Force)
Deserado Coal Company Mine	Coal mine to be feeder source for Bonanza Power Plant. Ultimately coal mine would reach annual production of 2.4 million tons a year.	7 miles north-east of Rangely, Rio Blanco County	1983 (413)	1986 (373)
Dorchester Coal Company (Fruita Mines 1 and 2)	Projects that coal mine would produce 4.0 million tons a year.	Northwest of Grand Junction, Mesa County	1986 (459)	1987 (510)
Gary Energy Corporation Oil Refinery	This 13,000 bpsd crude oil refinery was awarded DOE grant in 1980 to conduct feasibility study on upgrading oil, expanding the refinery to handle 10,000 bpsd of shale oil feed stock.	Northwest of Fruita, Mesa County	Unknown (100-150)	Current operation (140); with expansion (190-200)
Mack-Ute Power Plant Project (Southwest Units 1 and 2)	Colorado-Ute Electric Association proposes two 400-mW coal-fired power plants.	North of Mack, Mesa County	1985 (1,440)	1988 (388)
Sheridan Enterprises Coal Mine	Projects that coal mine would produce 5.4 million tons a year.	Northwest of Grand Junction, Garfield County	1980-1991 1990 (525)	1991 (550)
Taylor Draw Reservoir Project	Proposes 13,800 ac-ft/yr reservoir primarily for Rangely, Colorado, municipal water supply with secondary benefits in recreation, agriculture, industrial supplies and flood control. DEIS being prepared by U.S. Army Corps of Engineers. (Applicant--Water Users Association 1 of Colorado River Water Conservancy District.)	North of Rangely, Rio Blanco County	1983-1984 (50)	Mid-1984 (1)
Choke Cherry Coal Gasification Project	Proposed by Energy Transition Corporation to construct a coal gasification project. 60 million standard cubic feet of hydrogen would be produced using 1,400 tons of coal per day.	5 miles northwest of Axial, Moffat County	1984 (400)	Early 1986 (125)
Northern 1/Reinau 2	Coal mine	Rio Blanco County	Unknown	Unknown (672)
Danforth Hills 3	Coal mine	Rio Blanco County	Unknown	Unknown
Danforth Hills 1 and 2	Coal mine	Moffat County	Unknown	Unknown
Empire Energy Eagle 5,9	Coal mine	Moffat County	Unknown	Unknown (512)
Trapper	Coal mine	Moffat County	Unknown	Unknown
Colorado/Wyoming	Coal mine	Moffat County	Unknown	Unknown (382)
Utah International	Coal mine	Moffat County	Unknown	Unknown (175)
Energy-West/Sugar Loaf	Coal mine	Moffat County	Unknown	Unknown
Craig	Coal-fired power plant	Moffat County	Unknown	Unknown (308)
Cameo 1&2/Roadside GEX	Coal mine	Mesa County	Unknown	Unknown (400)
Coal Canyon	Coal mine	Mesa County	Unknown	Unknown
Cottonwood Creek	Coal mine	Mesa County	Unknown	Unknown
Southwest	Coal-fired power plant	Near Mack, Mesa, Colorado	Unknown	Unknown (325)
Colony	Oil shale	15 miles north of Grand Valley	Unknown (6,600)	Unknown (2,050)
Union	Oil shale	12 miles north of Grand Valley	Unknown (4,650)	Unknown (2,600)

TABLE R-1-3 (Concluded)

COLORADO INTERRLATED PROJECTS

Project	Project Description	Location	Peak Construction Period (Work Force)	Peak Operation Period (Work Force)
Catherial Bluffs	Oil shale	20 miles northwest of Rio Blanco	Unknown (5,200)	Unknown (2,100)
Chevron	Oil shale	38 miles north of DeBeque	Unknown (9,700)	Unknown (3,950)
Rio Blanco (federal tract C-a)	Oil shale	22 miles east of Rangely	Unknown	Unknown (2,700)
Mobil (Parachute)	Oil shale	6 miles north of Grand Valley	Unknown (2,200)	Unknown (1,900)
Exxon	Oil shale	14 miles north of Grand Valley	Unknown (0)	Unknown (0)
Superior	Oil shale	25 miles west of Meeker	Unknown (1,300)	Unknown (530)
Getty	Oil shale	8 miles northwest of Grand Valley	Unknown (0)	Unknown (0)
Multimineral	Oil shale	50 miles northwest of Rifle, Rio Blanco County	Unknown (400)	Unknown (200)
Naval Oil Shale	Oil shale	8 miles northwest of Rifle, Garfield County	Unknown	Unknown

NOTE: Not all projects listed in this table were considered in the cumulative impact analysis for all resources, because they were either included in the projected baseline for that resource or would not contribute to the cumulative impacts of the applicants' proposed projects. Acreage requirements for these projects are not included, because site-specific impacts of these acreages would not contribute to the cumulative impacts of the applicants' projects.

TABLE R-1-4

OIL PRODUCTION
High-Level Scenario

PROJECT	Shale Oil bpsd	Shale Oil bpy	Tar Sand Oil bpsd	Tar Sand Oil bpy
Enercor (Rainbow)			5,000	1,650,000
Enercor-Mono Power (P.R. Springs)			50,000	16,425,000
Geokinetics				
(Agency Draw)	23,000	7,555,500		
(Lofreco)	50,000	16,425,000		
Magic Circle	31,500	11,025,000		
Paraho	42,000	13,797,000		
Sohio			15,600	4,441,320
Syntana-Utah	57,000	18,755,000		
Tosco	44,953	14,767,000		
Combined Applicant Total	248,453	82,324,500	70,600	22,516,320
Interrelated Projects	100,000[a]	32,850,000	25,000[b]	8,212,500
CUMULATIVE TOTAL	348,453	115,174,500	95,600	30,728,820

NOTE: bpsd=barrels per stream day; bpy=barrels per year.

[a]White River Shale Project.

[b]Western Tar Sand and C & A Tar Sand Projects.

TABLE R-1-5

SUMMARY OF WORK FORCE REQUIREMENTS
High-Level Scenario

YEAR	CONSTRUCTION COMBINED APPLICANTS	CONSTRUCTION INTERRELATED PROJECTS[a]	CONSTRUCTION CUMULATIVE SUBTOTAL	OPERATION COMBINED APPLICANTS	OPERATION INTERRELATED PROJECTS[a]	OPERATION CUMULATIVE SUBTOTAL	CUMULATIVE GRAND TOTAL
1982	620	400	1,020	60	25	85	1,105
1983	2,280	2,470	4,750	260	115	375	5,125
1984	5,115	1,245	6,960	1,030	260	1,290	8,250
1985	9,855	1,620	11,475	3,180	1,415	4,595	16,070
1986	7,055	2,285	9,340	4,700	1,530	6,230	15,570
1987	3,905	3,405	7,310	6,670	585	7,255	14,565
1988	3,530	4,770	8,300	7,905	2,245	10,150	18,450
1989	2,580	4,610	7,190	9,375	2,785	12,160	19,350
1990	410	3,970	4,380	10,515	3,600	14,115	18,495
1991	285	3,680	3,965	10,930	4,020	14,950	18,915
1992	880	1,950	2,830	11,060	4,305	15,365	18,195
1993	1,550	285	1,835	11,315	4,855	16,170	18,005
1994	265	0	265	11,765	5,170	16,935	17,200
1995	200	0	200	11,890	5,170	17,060	17,260

Note: Figures are averaged peak for each year.

[a]Interrelated projects identified in Tables R-1-2 and R-1-3.

TABLE R-1-6

PEAK WORK FORCE BY PROJECT
High-Level Scenario

Projects	CONSTRUCTION Year	CONSTRUCTION Personnel	OPERATION Year	OPERATION Personnel
Enercor (Rainbow)	1984	350	1985	275
Enercor-Mono Power (P.R. Springs)	1985	2,215	1991	1,500
Geokinetics	1987	1,365	1988	3,010
Magic Circle	1987	820	1988	1,890
Paraho	1985	2,075	1987	1,100
Sohio	1988	1,900	1989	770
Syntana-Utah	1985	1,525	1995	2,100
	1989	1,350		
	1993	1,350		
Tosco[a]	1986	4,147	1990	2,330

NOTE: Personnel numbers are the peak for the indicated year.

[a]Work force estimates are expected to be within plus or minus 25 percent of the actual numbers.

TABLE R-1-7

ACRES OF VEGETATION DISTURBED, RECLAIMED, AND REMOVED
High-Level Scenario

Project		Plant Mine Facilities[a]	Access Roads	Product Pipelines	Water Pipelines	Power Transmission Lines	Natural Gas Lines	Construction Camps	Total
Enercor (Rainbow)	Disturbed	1,261	182	0	109	185	0	0	1,737
	Reclaimed	1,200	0	0	109	185	0	0	1,494
	Removed	61	182	0	0	0	0	0	243
Enercor-Mono Power (P.R. Springs)	Disturbed	5,990	206	91	121	135	0	1,800	8,343
	Reclaimed	5,290	0	41	121	135	0	0	5,587
	Removed	700	206	50	0	0	0	1,800[b]	2,756
Geokinetics	Disturbed	8,400	226	321	121	216	0	60	9,344
	Reclaimed	7,000	0	321	121	216	0	60	7,718
	Removed	1,400	226	0	0	0	0	0	1,626
Magic Circle	Disturbed	2,135	6	247	10	33	0	60	2,491
	Reclaimed	1,880	2	217	10	33	0	60	2,202
	Removed	255	4	30	0	0	0	0	289
Paraho	Disturbed	783	127	43	32	22	0	80	1,087
	Reclaimed	491	76	43	32	22	0	80	744
	Removed	292	51	0	0	0	0	0	343
Sohio	Disturbed	4,393	19	145	9	17	0	0	4,583
	Reclaimed	4,073	0	145	9	17	0	0	4,244
	Removed	320	19	0	0	0	0	0	339
Syntana-Utah	Disturbed	4,060	2	160	58	0	106	0	4,386
	Reclaimed	3,680	1	160	58	0	106	0	4,005
	Removed	380	1	0	0	0	0	0	381
Tosco	Disturbed	3,384	888	320[h]	41	157	0	150	4,940
	Reclaimed	2,436	474	320	41	157	0	150	3,578
	Removed	948	414	0	0	0	0	0	1,362
Combined Applicant Total	Disturbed	30,406	1,656	1,327	501	765	106	2,150	36,911
	Reclaimed	26,050	553	1,247	501	765	106	350	29,572
	Removed	4,356	1,103	80	0	0	0	1,800	7,339
Interrelated Projects	Disturbed	12,291[c]	20[d]	1,127[e]	unknown	2,116[f]	unknown	166[g]	15,720
	Reclaimed	8,340	0	1,127	unknown	2,116	unknown	166	11,749
	Removed	3,951	20	0	unknown	0	unknown	0	3,971
CUMULATIVE TOTAL	Disturbed	42,697	1,676	2,454	501	2,881	106	2,316	52,631
	Reclaimed	34,390	553	2,374	501	2,881	106	516	41,321
	Removed	8,307	1,123	80	0	0	0	1,800	11,310

NOTE: Disturbed refers to total acres of vegetation that would be disturbed during construction and operation.

Reclaimed refers to total acres of vegetation that would be reclaimed during the project life, including rights-of-way disturbance and spent shale disposal areas.

Removed refers to total acres of vegetation that would be occupied by surface facilities for the life of a project. Prior to project abandonment, the surface facilities would be removed and the disturbed acres reclaimed (with the possible exception of some roads that would be retained within the county network).

[a]Includes plant, mine works, strip mine (on tar sand projects), spent shale disposal area (on oil shale projects), and on-site roads. For each site-specific project, acreage associated with strip mine or spent disposal area is identified on Magnitude and Duration of Land Disturbance table found in Section 1.F, Data Summary, of the appropriate site-specific Chapter 1.

[b]Proposed new town of Westwater.

[c]Bonanza Power Plant, White River Dam, Chevron Resources Company, Western Tar Sand, White River Shale, C and A Tar Sand.

[d]White River Shale.

[e]Gary Energy Pipeline.

[f]Bonanza Power Plant and White River Shale.

[g]White River Shale.

[h]Does not include Salt Lake City Alternative Product Pipeline.

The amounts of water, oil shale and tar sand, and energy that would be required for development of the applicants' proposed projects and other interrelated projects are listed in Tables R-1-8 through R-1-10.

R-1.C LOW-LEVEL SCENARIO

The low-level scenario was designed to provide the federal, state, and local decision makers with a discussion of impacts that would be less than the high-level scenario. Based on past experience and present economic conditions, the production levels for the high-level scenario may not be totally attainable, especially within the stated time-periods. In addition, a concern was also expressed by the public and resource managers that the proposed full-scale production could exceed available resource capabilities.

An infinite number of alternative scenarios could have been designed by arbitrarily assigning time frame and production levels to each proposed project. However, any one of these may or may not have been viable or realistic. Therefore, each of the applicants was requested by BLM to supply a lower, break-even production level for its project. Most applicants stated that their proposed (full-scale) production levels were the lowest commercially (economically) viable levels that could be maintained. However, in order to comply with BLM's request, each applicant provided lower estimates (with individual qualifications and assumptions), which resulted in a combined estimated synfuel production level of 123,400 bpsd for the applicants and 248,400 bpsd when the interrelated projects are considered (Table R-1-11).

Under this scenario, the peak construction year for the applicants' proposals would be 1985 and the peak operation year would be 1993 (Table R-1-12). Work force for peak years by project is shown on Table R-1-13. The amounts of land, water, oil shale and tar sand, and energy that would be required for the applicants' proposals under this scenario and the interrelated projects are listed in Tables R-1-14 through R-1-17.

TABLE R-1-8

WATER CONSUMPTION (ac-ft/yr)
High-Level Scenario

	Construction			Operation	
	Surface Water			Surface Water	
Project	White River	Green River	Ground Water	White River	Green River
Enercor (Rainbow)	unknown	0	0	5,000	0
Enercor-Mono Power (P.R. Springs)	unknown	0	0	12,000	0
Geokinetics	0	unknown	0	0	1,350
Magic Circle	0	700	0	0	540
Paraho	640	0	0	2,900	0
Sohio	0	unknown	0	0	3,620
Syntana-Utah	1,200	0	0	7,000	0
Tosco	323	0	0	9,000	0
Combined Applicant Total	2,163	700	0	35,900	4,970
Interrelated Projects	unknown	unknown	3,800[a]	67,100[b]	88,800[c]
CUMULATIVE TOTAL	2,163[d]	700[d]	3,800	103,000	93,770

NOTE: ac-ft/yr = acre-feet per year

[a]Chevron Resources Company and C and A Tar Sand.

[b]White River Shale Project and 20,000 ac-ft/yr each for municipal use and agricultural use.

[c]Bonanza Power Plant, Western Tar Sand, White River Shale Projects, and 20,000 ac-ft/yr each for municipal use and agricultural use.

[d]Because of the indicated unknown quantities, these are minimum figures.

TABLE R-1-9

OIL SHALE AND TAR SAND MINED
High-Level Scenario

PROJECT	Oil Shale tpsd	Oil Shale tpy	Tar Sand tpsd	Tar Sand tpy
Enercor (Rainbow)			13,650	4,505,000
Enercor-Mono Power (P.R. Springs)			154,320	50,000,000
Geokinetics	72,000	23,652,000		
Magic Circle	70,000	24,500,000		
Paraho	75,000	24,000,000		
Sohio			48,130	16,161,000
Syntana-Utah	84,500	28,066,675		
Tosco	66,000	21,681,000		
Combined Applicant Total	367,500	121,899,675	216,100	70,666,000
Interrelated Projects	178,500[a]	58,637,250	67,500[b]	22,173,750
CUMULATIVE TOTAL	546,000	180,536,925	283,600	92,839,750

NOTE: tpsd = tons per stream day; tpy = tons per year.

[a]White River Shale Project.

[b]Western Tar Sand and C and A Tar Sand Projects.

TABLE R-1-10

ENERGY USED AND EXCESS PRODUCED DURING OPERATION
High-Level Scenario

Project	Electrical Power Used and Execess (MW) Produced[a]	Natural Gas Used (mmcfd)
Enercor (Rainbow)	7.5	0
Enercor-Mono Power (P.R. Springs)	5.7	0
Geokinetics	unknown (170)	0
Magic Circle	unknown (44)	0
Paraho	unknown (30)	29
Sohio	20	5
Syntana-Utah	40.9	52
Tosco	201	unknown
Combined Applicant Total	430.1[b] (244)	86
Interrelated Projects	unknown	unknown
CUMULATIVE TOTAL	430.1[b,c] (244)	86[c]

NOTE: MW = megawatts; mmcfd = million cubic feet per day.

[a]If excess power would be generated, it is shown in parentheses.

[b]Of this total, 275.1 MW would be purchased from a public utility.

[c]Because of indicated unknown quantities, these are minimum figures.

TABLE R-1-11

OIL PRODUCTION[a]
Low-Level Scenario

Project	Shale Oil bpsd	Shale Oil bpy	Tar Sand Oil bpsd	Tar Sand Oil bpy
Enercor (Rainbow)			5,000	1,650,000
Enercor-Mono Power (P.R. Springs)			15,000	4,927,500
Geokinetics				
(Agency Draw)	11,000	3,613,500		
(Lofreco)	20,000	6,570,000		
Magic Circle	16,400	5,746,560		
Paraho	10,500	3,450,000		
Sohio			5,000	1,679,000
Syntana-Utah	16,500	5,480,475		
Tosco	24,000	7,884,000		
Combined Applicant Total	98,400	32,744,535	25,000	8,256,500
Interrelated Projects	100,000[b]	32,850,000	25,000[c]	8,212,500
CUMULATIVE TOTALS	198,400	65,594,535	50,000	16,469,000

NOTE: bpsd = barrels per stream day; bpy = barrels per year.

[a]Production levels were provided by applicants in resonse to BLM's request for a lower production level. Applicants stated that the lower production levels provided were not commercially (economically) viable and could not be maintained indefinitely. According to the applicants, the lowest commercially viable production levels were their proposed (high-level) production levels.

[b]White River Shale Project.

[c]Western Tar Sand and C and A Tar Sand Projects.

TABLE R-1-12

SUMMARY OF WORK FORCE REQUIREMENTS
Low-Level Scenario

YEAR	CONSTRUCTION COMBINED APPLICANTS	CONSTRUCTION INTERRELATED PROJECTS[a]	CONSTRUCTION CUMULATIVE SUBTOTAL	OPERATION COMBINED APPLICANTS	OPERATION INTERRELATED PROJECTS[a]	OPERATION CUMULATIVE SUBTOTAL	CUMULATIVE GRAND TOTAL
1982	610	400	1,010	60	25	85	1,095
1983	2,135	2,470	4,605	260	115	375	4,980
1984	4,340	1,845	6,185	1,030	260	1,290	7,475
1985	7,250	1,620	8,870	2,405	1,415	3,820	12,690
1986	5,960	2,285	8,245	3,815	1,530	5,345	13,590
1987	3,335	3,405	6,740	4,615	1,585	6,200	12,940
1988	650	4,770	5,420	5,150	2,245	7,395	12,815
1989	450	4,610	5,060	5,405	2,785	8,190	13,250
1990	155	3,970	4,125	5,620	3,600	9,220	13,345
1991	100	3,680	3,780	5,700	4,020	9,720	13,500
1992	110	1,950	2,060	5,790	4,305	10,095	12,155
1993	120	285	405	5,880	4,855	10,735	11,140

NOTE: Figures averaged peak for the year.

[a]Interrelated projects identified in Tables R-1-2 and R-1-3.

TABLE R-1-13

PEAK WORK FORCE BY PROJECT
Low-Level Scenario

Project	CONSTRUCTION Year	Personnel	OPERATION Year	Personnel
Enercor (Rainbow)	1984	350	1985	275
Enercor-Mono Power (P.R. Springs)	1985	1,635	1988	450
Geokinetics	1984	850	1989	650
Magic Circle	1983	685	1987	900
Paraho	1984	1,450	1986	700
Sohio	1988	475	1989	175
Syntana-Utah	1985	1,796	1987	793
Tosco[a]	1987	3,077	1989	1,521

NOTE: Estimated figures are peak for the year.

[a]Work force estimates are expected to be within plus or minus 25 percent of the actual numbers.

TABLE R-1-14

ACRES OF VEGETATION DISTURBED, RECLAIMED, AND REMOVED
Low-Level Scenario

Project		Plant Mine Facilities[a]	Access Roads	Product Pipelines	Water Pipelines	Power Transmission Lines	Natural Gas Lines	Construction Camps	Total
Enercor (Rainbow)	Disturbed	1,261	182	0	109	185	0	0	1,737
	Reclaimed	1,200	0	0	109	185	0	0	1,494
	Removed	61	182	0	0	0	0	0	243
Enercor-Mono Power (P.R. Springs)	Disturbed	5,640	206	91	121	135	0	600	6,793
	Reclaimed	5,290	0	41	121	135	0	0	5,587
	Removed	350	206	50	0	0	0	600[b]	1,206
Geokinetics	Disturbed	7,700	226	321	121	216	0	40	8,624
	Reclaimed	7,300	0	321	121	216	0	40	7,993
	Removed	400	226	0	0	0	0	0	626
Magic Circle	Disturbed	2,135	6	247	10	33	0	40	2,471
	Reclaimed	1,880	2	217	10	33	0	40	2,182
	Removed	255	4	30	0	0	0	0	289
Paraho	Disturbed	380	15	0	0	22	0	80	497
	Reclaimed	100	0	0	0	22	0	80	202
	Removed	280	15	0	0	0	0	0	295
Sohio	Disturbed	4,153	19	0	9	17	0	0	4,198
	Reclaimed	4,073	0	0	9	17	0	0	4,099
	Removed	80	19	0	0	0	0	0	99
Syntana-Utah	Disturbed	915	2	160	29	0	53	0	1,159
	Reclaimed	757	1	160	29	0	53	0	1,000
	Removed	158	1	0	0	0	0	0	159
Tosco	Disturbed	3,384	888	320[h]	41	157	0	100	4,890
	Reclaimed	2,436	474	320	41	157	0	100	3,528
	Removed	948	414	0	0	0	0	0	1,362
Combined Applicant Total	Disturbed	25,568	1,544	1,139	440	765	53	860	30,369
	Reclaimed	23,036	477	1,059	440	765	53	260	26,090
	Removed	2,532	1,067	80	0	0	0	600	4,279
Interrelated Projects	Disturbed	12,291[c]	20[d]	1,127[e]	unknown	2,116[f]	unknown	166[g]	15,720
	Reclaimed	8,340	0	1,127	unknown	2,116	unknown	166	11,749
	Removed	3,951	20	0	unknown	0	unknown	0	3,971
CUMULATIVE TOTAL	Disturbed	37,859	1,564	2,266	440	2,881	53	1,026	46,089
	Reclaimed	31,376	477	2,186	440	2,881	53	426	37,839
	Removed	6,483	1,087	80	0	0	0	600	8,250

NOTE: Disturbed refers to total acres of vegetation that would be disturbed during construction and operation.

Reclaimed refers to total acres of vegetation that would be reclaimed during the project life, including rights-of-way disturbance and spent shale disposal areas.

Removed refers to total acres of vegetation that would be occupied by surface facilities for the life of a project. Prior to project abandonment, the surface facilities would be removed and the disturbed acres reclaimed (with the possible exception of some roads that would be retained within the county network).

[a]Includes plant, mine works, strip mine (on tar sand projects), spent shale disposal area (on oil shale projects), and on-site roads. For each site-specific project, acreage associated with strip mine or spent disposal area is identified on Magnitude and Duration of Land Disturbance table found in Section 1.F, Data Summary, of the appropriate Chapter 1.

[b]Proposed new town of Westwater.

[c]Bonanza Power Plant, White River Dam, Chevron Resources Company, Western Tar Sand, White River Shale, C and A Tar Sand.

[d]White River Shale.

[e]Gary Energy Pipeline.

[f]Bonanza Power Plant and White River Shale.

[g]White River Shale.

[h]Does not include Salt Lake City Alternative Product Pipeline.

TABLE R-1-15

WATER CONSUMPTION (ac-ft/yr)
Low-Level Scenario

Project	Construction: Surface Water White River	Construction: Surface Water Green River	Construction: Ground Water	Operation: Surface Water White River	Operation: Surface Water Green River
Enercor (Rainbow)	unknown	0	0	5,000	0
Enercor-Mono Power (P.R. Springs)	unknown	0	0	4,000	0
Geokinetics	0	unknown	0	0	615
Magic Circle	0	unknown	0	0	190
Paraho	450	0	0	680	0
Sohio	0	unknown	0	0	905
Syntana-Utah	150	0	0	2,000	0
Tosco	233	0	0	6,238	0
Combined Applicant Total	833	unknown	0	17,918	1,710
Interrelated Projects	unknown	unknown	3,800[a]	67,100[b]	88,800[c]
CUMULATIVE TOTAL	833[d]	unknown	3,800	85,018	90,510

NOTE: ac-ft/yr = acre feet per year

[a]Chevron Resources Company and C and A Tar Sand.

[b]White River Shale Project and 20,000 ac-ft/yr each for municipal use and agricultural use.

[c]Bonanza Power Plant, Western Tar Sand , White River Shale Projects, and 20,00 ac-ft/yr each for municipal use and agricultural use.

[d]Because of indicated unknown quantities, these are minimum figures.

TABLE R-1-16

OIL SHALE AND TAR SAND MINED
Low-Level Scenario

Project	Oil Shale tpsd	Oil Shale tpy	Tar Sand tpsd	Tar Sand tpy
Enercor (Rainbow)			13,650	4,505,000
Enercor-Mono Power (P.R. Springs)			46,300	15,000,000
Geokinetics	30,000	9,855,000		
Magic Circle	35,000	12,264,000		
Paraho	20,000	6,570,000		
Sohio			12,030	4,040,000
Syntana-Utah	26,630	8,180,850		
Tosco	35,237	11,573,350		
Combined Applicant Total	146,867	48,445,200	71,980	23,545,000
Interrelated Projects	178,500[a]	58,637,250	67,500[b]	22,173,750
CUMULATIVE TOTAL	325,367	107,082,450	139,480	45,718,750

NOTE: tpsd = tons per stream day; tpy = tons per year.

[a]White River Shale Project.

[b]Western Tar Sand and C and A Tar Sand Projects.

TABLE R-1-17

ENERGY USED AND EXCESS PRODUCED DURING OPERATION
Low-Level Scenario

Project	Electrical Power Used and Excess (MW) Produced[a]	Natural Gas Used (mmcfd)
Enercor (Rainbow)	7.5	0
Enercor-Mono Power (P.R. Springs)	3	0
Geokinetics	unknown (100)	0
Magic Circle	unknown (14)	0
Paraho	unknown	0
Sohio	3.75	0
Syntana-Utah	8.3	15
Tosco	100	0
Combined Applicant Total	122.55[b] (114)	15
Interrelated Projects	unknown	unknown
CUMULATIVE TOTAL	122.55[b,c] (114)	15[c]

NOTE: MW = megawatts; mmcfd = million cubic feet per day.

[a]If excess power would be generated, it is shown in parentheses.

[b]Would be purchased from a public utility.

[c]Because of indicated unknown quantities, these are minimum figures.

COMPARATIVE ANALYSIS OF SCENARIOS

The high- and low-level scenarios are compared in this chapter. Table R-2-1 provides a comparative analysis of significant unavoidable and quantifiable impacts that would result if all the applicants' proposed projects were developed at the two production levels. Unavoidable adverse impacts listed in the table are negative environmental impacts that would remain despite mitigation efforts. Adverse impacts that are of low significance or of very short duration are not included.

TABLE R-2-1

SUMMARY COMPARISON OF REGIONAL IMPACTS BETWEEN THE HIGH-LEVEL AND LOW-LEVEL SCENARIOS

Environmental Element[a]	High-Level Scenario: Combined Applicant Impact	High-Level Scenario: Cumulative Impact	Low-Level Scenario: Combined Applicant Impact	Low-Level Scenario: Cumulative Impact
Oil Production (barrels per year)	104,840,820		50,799,700	
Socioeconomics				
Population				
Construction	26,973	29,804	17,678	19,818
Operation	47,906	65,222	22,717	36,371
Employment				
Construction	16,482	18,115	10,383	11,577
Operation	21,087	28,745	9,935	16,150
Per Capita Personal Income				
Construction	2,153	2,263	1,637	1,790
Operation	928	1,115	259	366
Household Demand				
Construction	6,565	7,231	5,111	5,777
Operation	12,864	17,604	6,753	10,810
Teacher Demand				
Construction	147	163	117	133
Operation	449	615	218	343
Hospital Bed Demand				
Construction	36	40	29	33
Operation	88	121	46	72
Medical Personnel Demand				
Construction	55	61	42	47
Operation	127	175	64	105
Mental Health Personnel Demand				
Construction	5	5	4	4
Operation	6	14	5	8
Police Officer Demand				
Construction	19	21	15	17
Operation	44	63	22	38
Sewage Increase (gallons)				
Construction	997,300	1,094,000	730,400	812,500
Operation	2,305,900	3,158,300	1,137,000	1,669,700
Water Connection Demand				
Construction	2,993	3,284	2,187	2,435
Operation	6,894	9,427	3,397	4,987
Air Quality				
Total Emissions (kg/hr)				
Sulfur dioxide	2,834	4,550	1,009	3,919
Particulate matter	1,496	37,585	491	32,285
Nitrogen oxides	4,031	14,935	1,541	12,579
Hydrocarbons	448	2,914	166	2,442
Carbon monoxide	282	13,596	117	12,094
PSD Increments				
Class I				
Sulfur dioxide	Not exceeded[b]	Maybe exceeded[c]	Not exceeded	Maybe exceeded
Particulate matter	Not exceeded	Exceeded[d]	Not exceeded	Exceeded
Class II				
Sulfur dioxide	Not exceeded	Not exceeded	Not exceeded	Not exceeded
Particulate matter	Exceeded	Exceeded	Exceeded	Exceeded
Colorado Catagory I	Maybe exceeded	Maybe exceeded	Not exceeded	Not exceeded
NAAQS				
Sulfur dioxide	Not exceeded	Not exceeded	Not exceeded	Not exceeded
Particulate matter	Exceeded	Exceeded	Exceeded	Exceeded
Nitrogen oxides	Not exceeded	Not exceeded	Not exceeded	Not exceeded
Hydrocarbons	Not exceeded	Not exceeded	Not exceeded	Not exceeded
Carbon monoxide	Not exceeded	Not exceeded	Not exceeded	Not exceeded

TABLE R-2-1 (Concluded)

SUMMARY COMPARISON OF REGIONAL IMPACTS BETWEEN THE HIGH-LEVEL AND LOW-LEVEL SCENARIOS

Environmental Element[a]	High-Level Scenario Combined Applicant Impact	High-Level Scenario Cumulative Impact	Low-Level Scenario Combined Applicant Impact	Low-Level Scenario Cumulative Impact
Water Consumption				
White River				
Construction (ac-ft/yr)	2,163	2,163[e]	833	833[e]
Operation (ac-ft/yr)	35,900	103,000	17,918	83,018
Green River				
Construction (ac-ft/yr)	700	700[e]	unknown	unknown
Operation (ac-ft/yr)	4,790	93,770	1,710	90,510
Vegetation and Soils				
Disturbed (acres)[f]	36,911	52,631	30,369	46,089
Reclaimed (acres)[g]	29,572	41,321	26,090	37,839
Removed (acres)[h]	7,339	11,310	4,279	8,250
Wildlife				
Habitat, total disturbed (acres)	36,911	52,631	30,369	46,089
Habitat, long-term (30+years) disturbed (acres)	9,455	37,717	1,777	37,717
Agriculture				
Cropland lost (acres)				
Construction	5,934	6,557	4,858	5,537
Operation	10,539	14,349	5,410	8,690
AUMs lost				
Construction	753	1,289	526	853
Operation	2,169	2,829	1,497	2,393
Transportation Networks				
Level of Service Unacceptable[i]				
Construction	8	9	7	8
Operation	23	24	14	19
Recreation				
Recreation land affected (acres)	36,911	52,631	30,369	46,089
Mineral and Energy Resources				
Electric power used (MW)	234.1	234.1	122.6	122.6
Natural gas used (mmcfd)	86	86	15	15
Oil shale mined (tpyd)	121,899,675	180,536,925	48,445,200	107,082,450
Tar sand mined (tpyd)	70,666,000	92,839,750	23,545,000	45,718,750

NOTE: Figures given are the projected increase to baseline due to the proposed level of development.

ac-ft/yr = acre-feet per year; AUMs = animal unit months; kg/hr = kilograms per hour; mmcfd = million cubic feet per day; MW = megawatts; NAAQS = National Ambient Air Quality Standards; PSD = Prevention of Significant Deterioration; tpyd = tons per year.

[a]Only those elements that have impacts that vary significantly between scenarios are shown.

[b]Not exceeded - analysis indicates no exceedence of applicable standards even at the upper end of estimate range.

[c]Maybe exceeded - analysis indicates exceedence of applicable standards at upper end of estimate range but not at lower end.

[d]Exceeded - analysis indicates exceedence of applicable standards even at lower end of estimate range.

[e]Because of unknown quantities, these are minimum figures.

[f]Disturbed refers to total acres of vegetation that would be disturbed during construction and operation.

[g]Reclaimed refers to total acres of vegetation that would be reclaimed during the project life, including rights-of-way disturbance and spent shale disposal areas.

[h]Removed refers to total acres of vegetation that would be occupied by surface facilities for the life of a project. Prior to project abandonment, the surface facilities would be removed and the disturbed acres reclaimed (with the possible exception of some roads that would be retained within the county network).

[i]Figure given is number of level of service categories below C multiplied by number of highway links (or segments of road). For example, if 2 links would be reduced to Level D, 2 to Level E, and 2 to Level F, the following calculation would be made: (2 x 1) + (2 x 2) + (2 x 3) = 12. (Refer to Section R-4.A.7, Transportation Networks, for definition of terms.)

This chapter describes the baseline conditions of environmental elements that would be affected by the applicant's proposed projects and interrelated projects. The area described for a particular element is referred to as the area of influence, which is the area that would be significantly affected, either directly or indirectly, by the proposed projects. The extent of the area described varies for different resources, depending on how far reaching the effects of the combined projects would be. This chapter provides the background for the impact analysis presented in Chapter R-4.

Energy development, primarily oil and gas development, has already changed the environment of the Uintah Basin in a significant manner. The oil and gas development that has taken place and its effect on environmental elements is considered as part of the baseline conditions. It is assumed that oil and gas development will continue at a similar rate of growth until approximately 1985 and then will have a slower or diminishing rate of growth (State of Utah 1982). This projected oil and gas impact is also included in the baseline.

Impacts to some environmental elements were not found to be of sufficient significance to be analyzed in detail. Thus, the affected environment is not described in depth for these elements - topography, geology, noise, and climate. However, where pertinent, these topics are discussed under other resource headings. Refer to the vegetation, soils, and agriculture discussion (Section R-3.A.4 and the visual resources discussion (Section R-3.A.11) for pertinent topographic conditions; water resources (Section R-3.A.3) for geologic conditions; air quality (Section R-3.A.2) and vegetation, soils and reclamation (Section R-3.A.4) for climatic conditions.

R-3.A HIGH-LEVEL SCENARIO

R-3.A.1 SOCIOECONOMICS

The information included in this section is summarized from the Socioeconomics Technical Report (State of Utah 1982b).

The area of influence for socioeconomics encompasses Duchesne and Uintah counties in Utah, and the incorporated communities of Rangely and Dinosaur in Colorado. Also, included are the communities of Myton, Ballard, Vernal, and Roosevelt. This area was determined by initially comparing potentially affected populations of Utah and Colorado counties and incorporated communities under the baseline condition with population levels expected under the high and low scenarios. "Baseline" refers to the future population, assuming historical growth without the effects of the applicants synfuel projects or the interrelated projects (Tables R-1-2 and R-1-3). These comparisons were made for the peak construction and operation years for each scenario. Only those counties or incorporated communities which had a projected 10 percent or greater increase in population over the baseline were

included in the detailed analysis. This criteria is based on a Denver Research Institute study (Gilmore and Duff 1975), which identified 10 percent as a general threshold level in which a government's ability to meet increased service demands breaks down. The 10 percent growth standard is not expected to be reached for the Colorado counties.

Only the incorporated communities of Rangely and Dinosaur would have a projected increase exceeding the impact area criteria.

Grand County is included in the socioeconomic area of influence under the high-level scenario. Grand County is not included under the low-level scenario, since the population increases would not meet the 10 percent criteria. Within the high-level discussion, Grand County is only included in the socioeconomic area of influence for population, income, and employment. Grand County is not included in the housing and service demand discussions. The basis for this exclusion is that the vast majority of infrastructure demands would be met by the proposed new town of Westwater.

It is recognized that other areas and unincorporated communities, such as Jensen and Maeser located in the Ashley Valley, could be significantly affected. However, data specifically associated with these areas is limited. The <u>Socioeconomics Technical Report</u> (State of Utah 1982b) gives some data on projected baseline population and employment for the unincorporated areas of the Ashley Valley. It also presents population and employment impacts.

The following sections present the existing and future baseline conditions of the identified area of influence. The narrative is separated into a county discussion and a community discussion.

As mentioned, all the Colorado counties are expected to be affected less than the 10 percent criteria; however, to provide baseline information on employment for Colorado and to facilitate a regional impact discussion at the county level, the counties of Rio Blanco and Moffat, which contain Rangely and Dinosaur, respectively, were included in the socioeconomic area of influence These two counties are consolidated and referred to as the "Colorado area" in the county discussions.

The Uintah and Ouray Indian Reservation is also part of the identified area of influence. It is located in the Uintah Basin counties of Uintah, Duchesne, Wasatch and Grand. The reservation is the home of a federally recognized Indian tribe (Ute Tribe) and possesses the power of a sovereign state under treaties and Acts of Congress.

The reservation is composed of 1,039,010 acres of tribal lands, and an additional 430,000 acres of land where only mineral and subsurface rights are owned by the Ute Tribe (Map R-A-3, located in Appendix R-A). Within the northern part of the reservation, a "checkerboard" pattern exists between Indian and non-Indian lands.

The Ute Tribe is governed by the Uintah and Ouray Tribal Business Committee, which is comprised of six members, two elected from each of the three bands.

A constitution and by-laws were approved on January 19, 1937 and is the document that is being use to govern the tribe.

Because the State of Utah and the Uintah and Ouray Indian Reservation have different standards and procedures for recording their social and economic statistics, it is not possible to fully quantify baseline data and baseline projections for all aspects of the reservation's socioeconomic environment that would be affected. In the following discussion, baseline conditions on the reservation are described qualitatively where specific baseline data is unavailable.

Population and Employment

Tables R-3-1 and R-3-2 present baseline population and employment information for the area of influence. Baseline projections assume only trend growth without the effects of the applicants' developments or interrelated projects. In 1980, the population of the area of influence was 52,425. Uintah County had the largest population, comprising 39.1 percent of the total area population. The largest community in the region is Vernal, Utah. Its population in 1980 was 6,600 and comprised 32 percent of the Uintah County population. The majority of the population in the entire area ranges in age between 35 and 44. Of the small proportion of minorities within the total population, members of the Ute Indian Tribe comprise the largest percent. The over-65 age group is also a very small portion of the total population.

Future population projections (Table R-3-1) indicate that the area of influence will grow most rapidly between 1980 and 1985. The annual growth rate during this period will be 5.3 percent as compared to 1.2 percent during 1985 to 1995.

Table R-3-2 indicates that all communities included in the area of influence will grow rapidly during 1980 and 1985 under the baseline conditions. Growth will slow substantially between 1985 to 1995.

The total employment of the area of influence in 1980 was 24,945 (Table R-3-1). Uintah County had the greatest proportion with 34 percent. Future employment increases will follow the same trends as population; that is, employment will increase most during the 1980 to 1985 period. The rapid increase for the Colorado counties during 1980 to 1985 would be attributed to the expansion of the Deserado mine and other energy-related projects. The Bonanza Power Plant Unit 1, now under construction, will be a substantial contributor to Uintah County baseline growth, while the expansion of the oil and gas industry will be the major force behind Duchesne County's rapid growth during 1980 to 1985.

To qualify as an enrolled tribal member of the Ute Indian Tribe, a person must have at least 5/8 part Indian blood. This degree of Indian blood is established by tribal law. The Ute Indian Tribe currently has 1,890 enrolled tribal members. The tribe's population has increased significantly through the last decade, from 1,292 members in 1972 to 1,890 members in 1981, a 46

TABLE R-3-1

BASELINE POPULATION AND EMPLOYMENT BY COUNTY

Area	1980		1985		Annual Change 1980-85 (Percent)		1993		Annual Change 1985-93 (Percent)		1995		Annual Change 1985-95 (Percent)	
	Population	Employment	Population	Employment			Population	Employment			Population	Employment		
Duchesne County	12,565	4,893	17,778	7,203	6.9	8.0	18,712	7,057	0.6	-0.2	18,684	7,070	0.5	-0.1
Uintah County	20,522	8,483	25,730	10,585	4.6	4.5	29,982	11,895	1.9	1.5	29,863	11,886	1.5	1.2
Grand County	8,241	3,470	9,850	4,164	7.1	3.7	10,432	4,590	0.7	0.7	10,324	4,368	-0.5	-0.2
Colorado Area[a]	19,355	11,539	24,355	13,933	4.7	3.8	27,288	15,102	1.4	1.0	27,646	15,273	1.3	0.9
Area of Influence	60,716	28,415	77,713	35,885	4.9	4.8	86,414	38,444	1.3	0.7	88,517	38,599	1.2	0.2

Source: 1980 Census, U.S. Bureau of Census; projections from Utah Process Economic and Demograhic (UPED) computer model. A description of the UPED model can be found in Appendix R-F.

[a]Includes Moffat and Rio Blanco counties.

TABLE R-3-2

BASELINE POPULATION BY COMMUNITY

Community	1980	1985	Annual Change 1980-85 (Percent)	1993	Annual Change 1985-93 (Percent)	1995	Annual Change 1985-95 (Percent)
Vernal	6,600	9,291	7.1	11,421	2.6	11,369	2.0
Roosevelt	3,842	5,416	7.1	5,948	1.2	5,934	0.9
Ballard	558	775	6.8	985	3.0	976	2.3
Myton	500	705	7.1	775	1.2	773	0.9
Rangely	2,126	3,193	8.5	3,725	1.9	3,805	0.3
Dinosaur	312	501	9.9	420	-2.2	425	-1.7

Source: 1980 Census, U.S Bureau of Census; projections from Utah Process Economic and Demographic (UPED) computer model. A description of the UPED model can be found in Appendix R-F.

percent increase. In 1980, 85 percent of the enrolled tribal members lived on or near the reservation.

An additional 420 Indians live on or near the Uintah and Ouray Indian Reservation but are not enrolled Ute tribal members. However, they may be members of other federally recognized Indian tribes.

The Uintah and Ouray Indian Reservation has experienced out-migration rather than in-migration, due to the lack of attracting economic opportunities. Because of out-migration of young adults for economic reasons and the shorter lifespan, the Indian population is predominantly young. About 73 percent of the Indian population lies within the ages of 34 years and younger; the over-65 age group comprises only 4 percent of the total Indian population. Another factor contributing to a young age-structure is that many young adults return to the reservation with a family after leaving single, due to difficulties in adjusting to non-reservation life.

A total of 432 enrolled Ute Indian Tribal members are employed. An overwhelming amount of the potential Indian labor force (894) is unemployed, (462) or 52 percent. This is mainly due to the lack of economic opportunities on the reservation. A large share of the unemployed Utes have become discouraged and are no longer actively seeking work. Virtually all of the 432 employed tribal members work for either the tribe, Bureau of Indian Affairs, or a tribal enterprise. The Tribe lists fewer than 6 Ute members currently working in the oil and gas industry.

Personal Income

In 1979 (latest data available), average per capita personal income (PCPI) for the socioeconomic area of influence was \$8,606 (1980 dollars). This is 94 percent of the average income of Colorado and Utah (\$9,091). The Colorado area had the highest PCPI (9,977), while Duchesne had the lowest PCPI (\$7,161).

Future baseline projections indicate an increase of the PCPI for the impact area of influence. In 1985, the increased PCPI (in 1980 dollars) would be \$9,373. In 1995, this would increase to \$10,436. The Colorado area would maintain the highest PCPI for the socioeconomic area of influence. The counties included in the Colorado area are projected to continue to have the highest PCPI in the socioeconomic area. Most of the income rise would be a result of moderate expansion in the mining sector.

Of the 432 employed Ute tribal members, about 152 (or 35 percent) earn less than \$7,000 per year, and 280 or 64 percent earn \$7,000 per year or over. Some studies indicate that Indian households are larger than non-Indian households. One study indicates that the average Indian household size ranges from 4.0 to 5.6 persons (Facilitators 1980). When considering the large household size and generally low personal income, the average per capita personal income would be very low and in many cases, below the poverty level.

Housing

Based on data supplied by the Utah Department of Community and Economic Development (State of Utah 1982b), 68 percent of the dwelling units in Uintah and Duchesne counties are single-family, 21 percent are mobile homes, 4 percent are multi-family, and the remaining 7 percent are hotel or motel accommodations. Mobile homes provide a large share of the housing market in the area. Although their utilization had been on a steady decline since the mid-1970s, the trend reversed in 1980 when construction on the Bonanza Power Plant began.

Based on the Uintah Basin Association of Governments housing survey completed August 1981, 92 percent of the housing within Uintah and Duchesne counties is in standard or new condition. Uintah County had the most rapid rate of growth-40 percent from 1976 through 1981. The remaining counties have also received significant growth during the past 6 years. This trend is predicted to continue, particularly in Duchesne County.

The rapid growth in housing demand in Uintah County has led to a significantly higher average housing cost. A new 1,200-square foot home in Uintah County costs an average of $68,000, whereas a similar home in Duchesne County averages $60,000 (State of Utah 1982b). The relatively higher cost of housing within Uintah County has not significantly affected the vacancy rate, which is currently averaging 3 percent. Housing demand has led to virtually a no vacancy rate within Duchesne County. There are essentially no vacancies in the rental units, located primarily in Roosevelt and Vernal. Housing is also extremely tight, with very low vacancy rates in Rangely and Dinosaur. The demand for housing, particularly rentals and single family dwellings, has caused developers to propose a number of new apartment and condominium complexes, as well as new housing tracts.

Table R-3-3 lists the projected housing demand changes for the baseline for each county between 1980 and 1995. Table R-3-4 presents housing demand by community from 1980 through 1995 under the baseline assumption. As seen from the table, housing demand will be strong in all areas up to 1995. After this point, the expansion of demand should significantly decline. Between 1985 and 1995, demand in Dinosaur is expected to decrease.

There is currently a shortage of adequate housing within the Uintah and Ouray Indian Reservation. There are 55 families in need of housing and 42 dwelling units that need to be completely replaced. Another 50 dwelling units need to be renovated, while 315 dwelling units are in good repair.

Since 1964, the Department of Housing and Urban Development (HUD) and the Ute Indian Housing Authority, through formation of the Mutual Help Project, have made significant improvements in the reservation's housing. The Mutual Help Project has completed construction of 220 ownership units and 70 rental units as of September 30, 1981. The Special Projects Office of the Ute Tribe has also renovated and repaired 149 homes, primarily using HUD discretionary grants.

TABLE R-3-3

BASELINE HOUSING DEMAND BY COUNTY

Area	1980	1985	Annual Change Percent 1980-85	1993	Annual Change Percent 1985-93	1995	Annual Change Percent 1985-95
Uintah County	6,162	7,706	4.6	8,591	1.4	8,707	1.2
Duchesne County	3,773	5,323	7.1	5,385	0.2	5,393	0.1
Colorado Area[a]	6,795	8,536	4.7	9,563	1.4	9,688	1.3
Area of Influence	16,730	21,565	5.2	23,539	1.1	23,788	1.0

Source: 1980 Census, U.S Bureau of Census; projections from Utah Process Economic and Demographic (UPED) computer model. A description of the UPED model can be found in Appendix R-F.

[a] Includes Moffat and Rio Blanco counties.

TABLE R-3-4

BASELINE HOUSING DEMAND BY COMMUNITY

Community	1980	1985	Annual Change Percent 1980-85	1993	Annual Change Percent 1985-93	1995	Annual Change Percent 1985-95
Vernal	2,196	3,087	7.0	3,660	2.1	3,620	1.6
Roosevelt	1,133	1,622	7.4	1,714	0.7	1,709	0.5
Myton	143	201	7.0	213	0.7	212	0.5
Ballard	148	205	6.7	251	2.6	248	1.9
Rangely	743	1,116	8.5	1,303	1.9	1,330	1.8
Dinosaur	110	176	9.9	147	-2.3	149	-1.7

Source: Utah Department of Economic and Community Development (March 1982). Also refer to the Socioeconomics Technical Report (State of Utah 1982b).

There is still a need to provide 97 housing units. With the cutbacks in federal funds and escalating interest rates, the tribe is concerned about housing in the future.

Government Services and Facilities

The following presents brief assessments of the existing and future conditions under the baseline assumption (i.e., without the applicants' proposed projects) of various governmental services and facilities. Only those services or facilities determined to be significantly affected (those requiring substantial expansion) under the high- or low-level scenarios are discussed.

Education

At present, Duchesne County has an excess school capacity of 10.2 percent. The Rangely District has a current excess capacity of 52 percent. Dinosaur has one school operating at only 31 percent of total capacity. Uintah County school enrollment is exceeding present school capacity by 3.2 percent. Excess enrollment in Uintah County is planned to be partially alleviated by the construction of two planned new schools by 1985. In 1985 for Duchesne County there would be a projected baseline demand for 12 percent more classrooms and 10 percent more teachers. There will be a demand for twenty percent more of each by 1995. A 40 percent increase in demand for classrooms and a 30 percent increase in demand for teachers will occur in Uintah County by 1985. By 1995, there will be an additional 30 percent increase in demand for both.

There are 692 school-age members of the Ute Tribe who currently attend 8 elementary schools, 1 junior high, and 4 high schools in the area located adjacent to the reservation. There are also 50 students attending Bureau of Indian Affairs boarding schools. Almost 80 percent of the students are enrolled in the three schools nearest Fort Duchesne (the tribal headquarters). These schools are Todd Elementary, West Junior High in Fort Duchesne, and Union High School in Roosevelt. Union High School is currently overcrowded.

According to standard achievement tests administered by the Uintah School District, Ute Indian students fall substantially behind their non-Indian counterparts in school performance. In grades first through ninth, the Ute students, on an average, lag one year behind their counterparts. In the grades above the ninth, the Ute students fall 1.8 grades behind their non-Indian counterparts.

The drop-out rate is also very high for the Ute students. The 1970 Census data showed 72 percent of the tribal adults had only completed through the eighth grade, 26 percent were high school graduates, and 2 percent had attended college. The low percentage of high school graduates is further reflected by the class of 78-79's four year drop-out rate of 85 percent (out of 53 students who began the ninth grade, only 7 graduated).

HIGH-LEVEL SCENARIO-SOCIOECONOMICS

The Tribal Bureau Committee and the Indian Education Service cite the education problem as a significant social and economic concern. Because of these concerns, attempts have been made to improve tribal education through a variety of special education programs outside the public school system. The future of these programs, however, is in doubt because of federal budget cuts.

Medical

There are presently 3 hospitals serving the impact area, currently all have adequate capacity. The Rangely hospital, for instance, has a current utilization rate of 25 percent. Though current needs are met, all facilities will require expansion by 1985. A 27.3 percent increase in demand for hospital beds will occur in the socioeconomic area of influence by 1985. The increase in demand will be greatest for the hospital in Vernal. There is presently a need for additional nurses and physicians. The shortage of trained medical staff in the area is expected to become worse under the baseline. By 1985, the demand will increase by 40 percent for nurses and 100 percent for physicians.

There are still some traditional medical practices being conducted within the Uintah and Ouray Indian Reservation. In addition, the Indian Health Service of the U.S. Department of Public Health and Human Services also provides health care to the Ute Indians.

A medical clinic at the Duchesne County Hospital in Roosevelt called the Indian Health Clinic currently serves the tribe. A new medical clinic at Fort Duchesne is under construction and will replace this hospital clinic when completed. The clinic serves only those enrolled Utes, under the Termination Act of 1954.

The Indian Health Clinic provides outpatient care, family planning, immunization, pharmacology , and mental health services. Historical utilization of the clinic has been relatively stable from 1974 to 1980, with about 13,000 visits per year. Manpower for the Indian Health Clinic is generally adequate, with 15 full-time staff. The clinic administrator states that the relatively higher wage scale at the clinic has assisted their recruitment efforts in comparison with the other health care providers in the community. Dental services for the Utes are provided at Fort Duchesne by the U.S. Department of Public Health.

Mental Health

The counties of Uintah and Duchesne are served by the District IV Social Services Office in Vernal. Rangely and Dinosaur receive their mental health services in Grand Junction. As in most small towns and rural settings, services are inadequate, with an acute shortage of trained personnel, especially social workers. Under the baseline, the problem of inadequate services will become worse. By 1985, there will be a projected baseline demand for 3 additional psychiatrists and 11 additional social workers.

The most serious deficiency in Indian health care lies within the provision of mental health services. There is particularly a lack of needed services such as an in-patient alcohol detoxification center.

Law Enforcement

The area of influence presently requires expansion of existing jail facilities; there is also a need for additional police officers. Duchesne County has the most acute law enforcement needs. In 1985, the demand for police officers in Duchesne County will increase by 230 percent. The additional number of patrol cars is projected at 9, which would be a 30 percent increase over the present number. In 1985, the demand for police officers in Uintah County will increase by 55 percent in order to meet baseline needs. For the Colorado area, the increase in demand will be 326.7 percent by 1985. By 1995, public safety demands will stabilize, with a minor increased need in the impact area between 1985 and 1995.

The Ute Tribe has 14 police officers and 13 supplemental staff providing law enforcement on the reservation. The Law and Order Division cites an average of 1,500 arrests, 7,000 law enforcement complaints investigated, and 8,000 non-enforcement calls responded to per year. In addition, 6,000 prisoner days in detention facilities per year are also recorded for the reservation.

Fire Protection

Most of the area of influence is presently served by volunteer personnel. Fire protection is fairly adequate, considering the low population density. In 1985, there will be a demand for additional fire protection equipment and personnel, but this demand will not be as great as for some of the other services mentioned. The 30 percent increase in demand for fire pumpers in Vernal will be the greatest increase in the area of influence.

The Ute Tribe contracts with the town of Roosevelt for fire protection services. In addition, the Forestry Division of the Bureau of Indian Affairs provides some volunteer assistance.

Sewer

Duchesne County is served by sewer systems in Duchesne, Myton, Altamont, and Roosevelt. The Duchesne City system, constructed in 1969, has a 4,000-person capacity. Myton built a new sewer system in conjunction with its water system in the 1970's. A doubling of the existing Myton population can be absorbed by the current system. Altamont has a small lagoon with 100 existing connections. Roosevelt recently constructed a new sewage treatment facility, which can handle an estimated 12,000 persons.

Duchesne County has room within its sewer system for expansion to absorb much of the projected baseline growth. However, it is the Vernal system that is projected to receive the greatest growth. The sewer system in the Vernal area

is currently exceeding capacity, but the community is already planning a new valley-wide 40,000-person capacity facility. Not all homes in the valley will have access to the sewer system, so these will continue to be on septic tanks. The community of Rangely has 3 aerated sewer lagoons with 663 hookups. Some 2,300 people are served, with a capacity of 4,000 people. Capacity flow is 0.19 million gallons per day, with an average flow of 0.16 million gallons per day. The present population in Dinosaur is served by septic systems. Currently, the community is building a sewer system. The capacity is unknown at this time.

The most common methods of sewage disposal on the reservation are septic tanks and leaching fields. In addition, the Indian Health Service has installed a sewer system for basic sanitation needs on the reservation.

Water

The Ashley Valley is served by four water districts, located in Vernal, Maeser, Jensen, and the unincorporated areas of Uintah County. At present, the Ashley Valley system is inadequate, serving 16,000, but it is only designed for a 10,400 person capacity. This is a short-term problem, however, since the present system is being expanded to a 40,000- to 50,000-person capacity.

Ballard purchases its water from the Ute Tribe and has no expected water problems. Roosevelt is presently utilizing wells for water supply. Roosevelt currently has adequate capacity, but it has problems with water pressure. In Roosevelt, future demand will outpace present capacity. Myton obtains its water from the Duchesne River via a canal. The projected baseline does not forecast capacity problems.

The Ute Tribe holds four water rights, three on Willow Creek in Uintah County and one on Florence Creek in Grand County. The "Winters Doctrine" also grants Native Americans the "beneficial use" of waters which run across or border the reservation for agricultural purposes.

Government Finance

Uintah County

The major local governments in Uintah County include Uintah County, Uintah School District, and the City of Vernal. Special service districts operating within Uintah County include the Jensen and Maeser Water Improvement Districts, the Uintah Water District, and the Ashley Valley Water and Sewer Improvement District.

In 1980, Uintah County assessed a 16.63 mill levy against an assessed valuation of $102.6 million, which provided $1.7 million in taxes. The allowable debt for the county is $9.1 million. An outstanding hospital bond of $2.4 million leaves $6.7 million available for future use. In 1980, the

total revenues for the county totalled $4.4 million and the expenditures were $4.6 million; the largest share went for highways and public improvements.

In 1980, Uintah School District also had an assessed valuation of $102.6 million and with a mill levy of 43.75. The school district received $4.5 million in taxes.

In 1980, Vernal had a much smaller assessed value ($18.8 million) and collected $61,850 in taxes with a mill levy of 3.29. The allowable indebtedness for Vernal is 20 percent or $3.8 million. The city had no indebtedness, which left the full $3.8 million available. The Maeser Water Improvement District had a mill levy of 8.3 and collected $8,570 in taxes. The district has an allowable indebtedness of $508,250 and currently has $380,000 in outstanding debt. The Jensen Water Improvement District has a 4.7 mill levy, an allowable debt of $446,800, and currently has an outstanding revenue bond of $71,500 which is being paid through user fees. Ashley Valley Water and Sewer has an assessed valuation of $16.9 million, a mill levy of 13.48, and allowable indebtedness of $2.5 million.

Duchesne County

The major local jurisdictions in Duchesne County include Duchesne County, Duchesne School District, the town of Altamont and the cities of Duchesne, Myton, and Roosevelt. Special service districts operating within the county include Duchesne Mosquito District and the Central Utah Water District.

In 1980 Duchesne County had an assessed valuation of $133.1 million, and a mill levy of 9.05 mills. The county had no outstanding debts, leaving the entire allowed indebtedness of $13.3 million available for future use. In 1980 the county had total revenues of $3.7 million and expenditures of $4.1 million. The largest single outlay was for highway and public improvements.

Duchesne School District had 38.6 mills on an assessed valuation of $133.1 million and collected $5.1 million in taxes during 1980.

The Duchesne Mosquito District had an assessed valuation of $133.1 million, a mill levy of 0.8, and collected $106,480 in taxes in 1980.

Colorado Area

In 1980, Rio Blanco County had an assessed value of $206.1 million. The mill levy was 8.45 and the outstanding debt was $450,000. Total revenues were approximately $5.5 million, while total expenditures in 1980 were $4.9 million. The resulting surplus was $0.6 million. For the community of Rangely, the assessed value in 1980 was $5.0 million. Total revenues were $1,293,000, while expenditures totaled $1,351,200. This resulted in a deficit of $58,200.

In 1980, Moffat County had a baseline value of $187.0 million. The mill levy was 13.85 and the outstanding debt was $2.3 million. Total revenues were

$10.5 million and total expenditures were $7.4 million, leaving a surplus of $3.1 million. The community of Dinosaur in 1980 had an assessed value of $390,850. Revenues totaled $142,748 and expenditures were $80,346, resulting in a surplus of $62,402. Total outstanding debt was zero.

Tribal Jurisdiction and Finance

The Uintah and Ouray Indian Reservation is an isolated jurisdictional entity within the State of Utah. The reservation is a distinct political unit. The Ute Tribal Business Committee possesses sovereign powers to regulate tribal members within the reservation boundaries. These responsibilities include the right to regulate land use, taxation, and tribal membership. The tribal government also has strong interest in divorce, child custody, inheritance, and contracts involving tribal members and non-members. Tribal courts have jurisdiction over Indians who commit crimes within the reservation. However, the federal government has assumed jurisdiction over major crimes committed on Indian lands. Overall, the rights of the tribal government to regulate persons and activities are absolute, except where the federal government has pre-empted these powers. The Ute Tribe is concerned over the decreasing isolation of the reservation caused by the influx of non-members (especially non-Indians) onto reservation lands and surrounding lands, the increasing mobility of tribal members, and the increased interaction between tribal members and non-members.

The reservation has experienced economic stagnation. The Tribal Business Committee currently wishes to establish goals which would encourage economic development projects. Funds have been requested through HUD, EDA, and BIA programs to create an economic base and increase employment. However, these programs have been so reduced that in some cases many programs have had to cease. The levels of inflation felt by tribal members is dependent upon the degree of reliance on non-tribal goods and services. In just about all cases, the economic base of the reservation does not allow for isolation from regional economic trends such as inflation. The effect of this regional influence and the extent tribal programs offset this influence is not known.

Other Sectors

Agriculture

Until the early 1970's, agriculture (farming and ranching) was the main economic source in the region. Since then, nonagricultual industries, mainly petroleum exploration and production and tourism, have experienced growth and contributed to the regional economy. This trend is projected to continue, and the agricultural sector will decline proportionately in economic importance.

Hunting, Fishing, and Nonconsumptive Use Expenditures

Hunting, fishing, and nonconsumptive use of wildlife (birdwatching, wildlife photograpy) bring in income to the local economy in the form of local

expenditures by outsiders. Purchases are made for lodging, food, gas, and sporting goods. Historic expenditures (1976-1980) in Uintah County are discussed in Section R-3.A.4, Wildlife.

Quality of Life

Most of the social effects associated with the applicants' proposed projects would occur in Uintah and Duchesne (particularly the city of Roosevelt) counties, Utah. Due to oil and gas activity over the last several years, they have already experienced a moderate level of industrialization and significant population growth. This experience gained from shifting the local economic bases from agriculture to industrial uses should be a valuable asset to both officials and residents (Mountain West Research 1982). The traditional western farming and ranching communities are now losing their identity because of recent energy development. Despite a high proportion of Mormon residents, the importance of this factor in community life is declining, as large numbers of newcomers have entered the communities (BLM 1982c).

Social changes are already evident as the communities have become more diverse, segmented, and impersonal. Attitudes toward growth among leaders and residents are very positive, but there is uncertainty with regard to synfuel proposals being implemented.

Services are already strained by oil and gas-induced growth and likely will be further stressed during the next several years. Housing, education, law enforcement, mental health, and similar services and facilities are under considerable pressure. Community leaders face growth management problems at this time.

There appears to be limited misgivings among residents about the social costs and benefits of growth. All things considered, most residents in the area favor the placement of industrial facilities, and the associated jobs (APA Planning and Research 1981).

Existing living conditions (housing, employment opportunity, education achievement, and similar factors) on the Uintah and Ouray Indian Reservation are of concern to the Ute Tribe. Disparity between on-reservation and off-reservation conditions, among tribe members and relative to non-Indians in the area, contributes to the feeling among some tribe members of being materially deprived. Culturally, it appears that the work ethic and competitive drive for economic well being are not supported or rewarded to the same extent for Indians as for non-Indians (National Institute for Socioeconomic Research 1982).

R-3.A.2 AIR QUALITY

The information presented in this section is summarized from the more detailed Air Quality Technical Report (Systems Applications Inc. 1982).

Meteorology

The area of influence considered in the air quality impact analysis includes the western slope of the Rocky Mountains in eastern Utah and the northwestern portion of Colorado. The area is generally characterized by complex terrain; but large portions of the region are relatively flat plateaus. The Uintah Basin is relatively flat, high plateau country which becomes progressively more elevated, rugged, and mountainous toward the east. In Colorado portions of the Flat Tops Wilderness Area rise above 10,000 feet mean sea level (MSL).

The climate of the region is semi-arid to arid. Because of the typically dry atmosphere, there is a high frequency occurrence of bright, sunny days and clear nights. This, in turn, allows rapid heating of the ground surface during daylight and rapid cooling in the dark. Since heated air rises and cooled air sinks, winds tend to blow upslope during daytime and downslope at night. This upslope and downslope cycle occurs generally in all the geographic features, including the mountain range slopes and river courses. The larger the horizontal extent of the feature, the greater the volume of air that moves and the thicker the layer of moving air. Because of complexity of the terrain features, the cyclic air movements are also complex, with thin layers of moving air embedded within the thicker ones.

The lower level, thermally affected winds are also embedded within larger scale upper wind systems (synoptic winds). Synoptic winds in the region are predominantly west to east, are characterized by daily weather variations, and are significantly channeled by regional and local topography.

Winds at 6,000 feet above the ground were derived for the area of influence from 1978 and 1979 measurements from National Weather Service stations at Denver and Grand Junction, Colorado; Lander, Wyoming; and Salt Lake City, Utah. The wind flow is almost always from the western sectors, with the west-southwesterly winds occurring most frequently.

Low level winds were characterized by measurements taken at four sites:

- Uintah Basin: the White River oil shale project site, federal lease tracts U-a and U-b.
- Piceance Basin: the Cathedral Bluffs oil shale project site, federal lease tract C-b.
- Grand Junction, Colorado.
- Craig, Colorado.

Generally, winds in the Uintah Basin are characterized by shallow morning drainage flow existing at about the 1,000-foot level and below. Weak winds from the south and southwest predominate. In the afternoon, northwest up-slope flow at the surface, and south to southwest synoptic-scale winds above the first 500-feet are frequent. Synoptic scale winds are those typically associated with weather related to high- and low-pressure systems of a few hundreds to a few thousands of kilometers in extent.

Atmospheric Stability

The frequency of morning and afternoon stability categories at the 1,500-foot level at the White River oil shale site are shown in Table R-3-5. Morning atmospheric stability conditions tend to be stable, as would be expected for drainage flow conditions. Afternoon conditions tend to be neutral most of the time. Winter and fall periods show a higher percentage of stable afternoon conditions.

A high frequency of inversions in the area can be attributed to the nighttime cooling and sinking air from the high elevations to the low lying areas in the basins. In the Uintah Basin, the average thickness of the inversions are greatest in the fall and summer and are least in spring and winter. Although winter inversions are generally shallow, they tend to be more stable because of reduced surface heating.

Measurements from the White River oil shale site (federal lease tracts U-a and U-b) were used to characterize surface winds, upper winds, and atmospheric stability for the Uintah Basin. Measurements from the Cathedral Bluffs oil shale site (federal lease tract C-b) were used for the Piceance Basin area. Grand Junction and Craig, Colorado, weather data were also used. Data from these stations were used to model wind fields for the region taking into account the effects of complex terrain. A more detailed decription appears in Appendix R-G, and a complete discussion appears in the Air Quality Technical Report (Systems Applications Inc. 1982).

Existing Air Quality

The air quality of the area of influence is typical of a largely undeveloped region in the western United States. The measured long-term average concentrations of pollutants are well within the ambient air quality standards except in populated areas where windblown dust and emissions from exposed soil surfaces and general road use cause routine exceedances of the standards. A 3-year average of pollutant concentrations measured at proposed synfuel development sites is shown in Table R-3-6.

Table R-3-7 summarizes total suspended particulates measurements made by the states of Utah and Colorado in the area of influence. For most of the proposed project areas, the total suspended particulates standards are exceeded, probably from windblown dust or dust from unpaved or graveled roads. On the basis of the ambient total suspended particulates measurements and a comparison of local particulates emission inventory, it is estimated

TABLE R-3-5

ATMOSPHERIC STABILITY AS MEASURED AT THE WHITE RIVER SHALE PROJECT SITE

	Morning Percent				Afternoon Percent			
	Unstable (A,B,C)	Neutral (D)	Stable (E)	Very Stable (F)	Unstable (A,B,C)	Neutral (D)	Stable (E)	Very Stable (F)
Annual	1	25	74	0	16	52	31	2
Winter	0	33	65	2	6	40	50	4
Spring	0	29	71	0	26	64	10	0
Summer	0	14	87	0	29	54	17	0
Fall	2	24	74	0	10	53	36	2

NOTE: Pasquill-Gifford Stability Categories A, B, and C have been grouped under unstable; D is neutral; E is stable; F is very stable.

TABLE R-3-6

MEASURED AMBIENT CONCENTRATIONS OF CRITERIA POLLUTANTS IN UINTAH BASIN

Pollutant	3-Year Average Measured Concentrations in Uintah Basin (ug/m^3)	Annual Average Federal Ambient Air Quality Standard (ug/m^3)
Sulfur dioxide (SO_2)	1.3	80
Total suspended particulates (TSP)	15.7	60
Carbon monoxide (CO)	200	10,000[a]
Ozone (O_3)	71	240[b]
Nitrogen dioxide (NO_2)	1.3	100

Source: Systems Applications Inc. 1982.

[a]8-hour standard.

[b]1-hour standard.

TABLE R-3-7

MEASURED AMBIENT CONCENTRATIONS OF TOTAL SUSPENDED PARTICULATES (TSP) IN AREA OF INFLUENCE

Site	Year	Maximum 24-hr	Annual Geometric Mean
Colorado			
Fruita	1979	173[a]	76[b]
	1980	166[a]	69[a]
Palisade	1979	130	43
	1980	163[a]	47
Rifle	1979	694[b]	128[b]
	1980	510[b]	156[b]
Glenwood Springs	1979	188[a]	57
	1980	203[a]	68[a]
Meeker	1980	212[a]	66[a]
Rangely	1980	273[b]	70[a]
Craig	1980	382[b]	86[b]
Utah			
Green River	1979	196[a]	64[a]
	1980	163[a]	53
Vernal	1978	105	31
	1979	106	35
	1980	80	32
Tracts U-a, U-b	1978	63	15
	1979	53	13
Federal and State Ambient Air Quality Standards			
Primary		260	75
Secondary		150	60

NOTE: Data obtained from measurements made by the states of Utah and Colorado.

[a]Exceedance of secondary standard.

[b]Exceedance of primary and secondary standards.

that the annual average total suspended particulates concentration in most other sites in the area of influence currently range between 20 and 40 micrograms per cubic meter (ug/m^3). For comparative purposes, the annual primary National Ambient Air Quality Standards for total suspended particulates is 75 ug/m^3.

Visual-range (visibility) measurements have been made by the National Park Service at Dinosaur National Monument in 1978 and 1979. Visibility in the region is usually good, with average visual ranges of 110 to 120 miles in the summer with ranges between about 60 and 190 miles. The good visibility conditions reflect the presently low regional sulfur dioxide and ambient total suspended particulates concentrations.

All areas within the air quality area of influence are presently classified as Class II under the Prevention of Significant Deterioration (PSD) regulations, except the following wilderness areas and national parks, which are classified as Class I.

- Flat Tops Wilderness Area
- Maroon Bells/Snowmass Wilderness Area
- Mount Zirkel Wilderness Area
- Arches National Park
- Canyonlands National Park

Four areas of special concern within the air quality area of influence include Dinosaur and Colorado National Monuments, the proposed High Uintas Wilderness area, and the Uintah and Ouray Indian Reservation. The Dinosaur and Colorado National Monuments and the proposed High Uintas Wilderness area have been determined by the respective federal land managers to have air quality-related values that are important attributes of the area worthy of Class I air quality protection. Additionaly, the State of Colorado will be enforcing the Colorado Category I designation in identified areas of Colorado including Dinosaur and Colorado National Monuments (Permit Processing Memo #18). Colorado Category I has the same sulfur dioxide limitation as the federal PSD Class I. The Ute Indian Tribe has expressed concern regarding air quality impacts over their lands and the use of the Class II increment within their boundaries and the implications for future development on their lands.

Wilderness Study Areas (WSA), which are being investigated by BLM for possible recommendation to Congress for redesignation to Wilderness status, are within the air quality area of influence. (A partial listing is included in Table R-3-17, Section R-3.A.9.)

A great deal more uncertainty exists with WSAs as to the significance of air quality impacts. If any of these areas were to be recommended for and subsequently redesignated as Wilderness by Congress, it would be the prerogative of the state to reclassify the wilderness to Class I. Until such time as they are reclassified by the states to Class I, BLM would manage the areas as Class II.

R-3.A.3 WATER RESOURCES

Surface Water

For surface water the area of influence lies in a geologic basin traversed by three major rivers: the Green, the White, and the Duchesne. Table R-3-8 provides details on each river's characteristics. Both the Green and White rivers would be potential sources of water supply for synfuels development. The Duchesne River is not an applicant-specified water supply; however, it is a site of significant water resources development.

The Green River is the major drainage in the region. Its flow is regulated by Flaming Gorge Reservoir and averages 4,563,000 acre-feet per year (ac-ft/yr) at Green River, Utah. It has a drainage area of 44,850 square miles, including arid grasslands and moist, wooded mountains. Due to this, extreme daily discharges range from 68,100 cubic feet per second (cfs) to 255 cfs, averaging 6,298 cfs; however, since the construction of Flaming Gorge Reservoir, these extremes have been moderated. Water quality parameters also vary widely.

The maximum sediment discharge on record is 2,230,000 tons per day and the minimum is 54 tons per day, with a total of 10,281,496 tons for water year 1977. Dissolved solids for water year 1977 ranged from 290 milligrams per liter (mg/l) to 703 mg/l.

The White River currently has no storage, and because of this, shows extreme variation in flow. In addition, the flow of the White River from Colorado to Utah could be reduced by an unknown amount due to future water storage and other water use in the headwaters of the White River. The Ute Indian Tribe has a unquantified water right along the lower White River (Winters Doctrine, discussed in more detail under the Native American Water Rights heading of this section). The State of Utah, Division of Water Resources, has proposed the White River Dam with a reservoir having 109,250 ac-ft of total storage capacity, which would create a reliable water source for energy development. The White River, at its confluence with the Green River, has an average annual flow of approximately 479,600 ac-ft and drains 5,120 square miles. Extreme daily discharges range from 4,260 cfs to 1.6 cfs, averaging 662 cfs. The maximum sediment discharge on record is 286,000 tons per day and the minimum is 0.69 tons per day, with a total of 2,046,110 tons for water year 1980. Dissolved solids for water year 1980 ranged from 261 mg/l to 702 mg/l.

The Duchesne River is heavily used for irrigation and is undergoing development for out-of-basin export. This river was included in this study, because interrelated projects (Tables R-1-2 and R-1-3) would decrease its flow and may alter the flow or water quality in the lower Green River. At its mouth, the Duchesne River has an average annual flow of approximately 473,500 ac-ft and drains an area of 4,247 square miles. Extreme daily discharges range from 10,300 cfs to 2.2 cfs, averaging 557 cfs. There are no sediment records for this river, and dissolved solids have extreme variations.

TABLE R-3-8

CHARACTERISTICS OF MAJOR STREAMS

Characteristic	USGS Gauging Stations: Green River at Green River, Utah	White River at Mouth near Ouray, Utah	Duchesne River Near Randlett, Utah
Period of records (yrs)	81	6	38
Drainage area (mi^2)	44,850	5,120	4,247
Average annual flow (ac-ft)	4,563,000	479,600	473,500
Maximum daily flow (cfs)	68,100	4,260	10,300
Minimum daily flow (cfs)	255	1.6	2.2
Average daily flow (cfs)	6,298	662	557
1977 Sediment discharge (tons)	10,281,496	2,046,110	ND
Maximum sediment discharge (tons/day)	2,230,000	286,000	ND
Minimum sediment discharge (tons/day)	54	0.69	ND
1977 Maximum TDS[a] (mg/l)	799	702	ND
1977 Minimum TDS[a] (mg/l)	214	261	ND

Source: USGS Water Resources Data for Utah, water year 1980.

Note: ac-ft = acre-feet; cfs = cubic feet per second; mg/l = milligrams per liter; mi^2 = square miles; ND = no data; yrs = years.

[a]Total dissolved solids (TDS) is the same parameter as salinity predicted by Colorado River Simulation Model.

According to USGS records, tributary streams in the area of influence show similar variations in flow and quality; however, their discharge is much less than the major rivers, and they often dry up. The basin is characterized by high flows and low dissolved solids during snowmelt (May, June, and July) and low flow and high dissolved solids during September through February when ground water becomes the primary contributor to flow.

Floodplains

There are three major floodplains in the area of influence; the largest two are occupied by the Green River and White River, and the other by the Duchesne River. Escarpments and bluffs along the rivers delineate the floodplain landform. The Green River floodplain ranges in width from 2 miles to only slightly wider than the river. That portion below Dinosaur National Monument averages 5,000 feet wide; whereas, the portion of the floodplain in the monument is constricted in narrow canyons by escarpments and bluffs. The White River floodplain from the Colorado border to the Green River is well defined by steep canyon walls. It averages 2,000 feet across and is more than 5,000 feet wide at its confluence with the Green River. The Duchesne River floodplain ranges in width from 1 mile near its mouth to only slightly wider than the river. All other drainages in the region have floodplains that are of little basin-wide consequence.

Ground Water

Ground water in the geologic basin is found in two types of aquifers--unconsolidated deposits of recent deposition, primarily stream alluvium and structural rock units that make up the basin. For purposes of this EIS, water in stream alluvium was treated as surface water, and the impacts of its use are discussed in the surface water section. There are two major structural rock units that function as aquifers in the geologic basin, the Birds Nest aquifer and the Douglas Creek aquifer (Homes 1980). The Birds Nest aquifer is moderately saline (9,870 mg/l total dissolved solids). It occurs primarily in the middle of the basin. The Douglas Creek aquifer is a fresh water aquifer (4,000 mg/l total dissolved solids) and occurs throughout most of the basin.

Recharge to the Birds Nest, Douglas Creek, and other small, discontinous structural rock aquifers plus recharge to alluvial aquifers is estimated to be 500,000 ac-ft/yr (Hood and Waddell 1968). Most of this recharge enters the system in the mountains and moves to the basin in consolidated rocks. The remaining recharge occurs in the basin, principally on the alluvial surfaces. Approximately 200,000 ac-ft/yr of the ground water recharge returns to the streams in the upland areas, by way of springs (Hood et al. 1976). Therefore, there is approximately 300,000 ac-ft/yr of potential ground water supplies available for use in the basin.

Native American Water Rights

Water is an important subject associated with the Uintah and Ouray Indian Reservation. It has been established that the Indians are entitled to water for reservation use as set forth in Winters vs. United States 207 U.S. 564 (1908) and reaffirmed in Arizona vs. California 373 U.S. 546 (1963). The doctrine holds that when an Indian reservation was created "...there was reserved or confirmed not only the land but also the right to enough water to irrigate the irrigable portions of the reserved lands or otherwise fulfill the purposes of the reservation."

The exact amount of water to which the Ute Tribe is entitled has not yet been determined. At present the Ute Tribe and the State of Utah are negotiating an agreement whereby the tribe's water rights may be quantified without resorting to litigation. However, until such time as the Ute Water Compact is finalized, or some other means is employed to establish and quantify with certainty the tribe's rights, the total extent of the tribe's water ownership is uncertain. That the tribe does, in fact, have water rights is unquestioned; it is the nature and extent of these rights that remain unsettled. Various studies have used assumptions for the amount of water which eventually may be ascertained as the Ute Tribe entitlement. These assumptions range from 61,598 ac-ft/yr(BLM 1982b, page 318) to 80,000 ac-ft/yr (U.S. Bureau of Reclamation Colorado River Simulation System).

R-3.A.4 VEGETATION AND SOILS

The area of influence is located in two major land resource areas (SCS 1978). The largest part is in the Central Desertic Basins. Mountains and Plateaus areas, which has an average annual precipitation of 6 to 12 inches and an average frost-free season of 80 to 125 days. The remaining part located in the southern portion of the area of influence, is in the southern Rocky Mountain area, which has an average annual precipitation of 12 to 20 inches and an average frost-free season of 60 to 110 days.

Vegetation

The area of influence generally includes the desert and intermountain biomes composed of several vegetation types. This EIS addresses six major vegetation types, which combine several vegetation communities within the region (Table R-3-9). These types generally follow a pattern from north to south that vary according to elevation, aspect, and precipitation, beginning with mixed-desert shrub, which grades into pinyon-juniper, upland brush type, upland sage-grass near the upper end of the Bookcliffs area, and finally, as the area drops to the Colorado River, the Bookcliffs woodland type, which exhibits extreme variation with elevation and aspect. Riparian vegetation type is found throughout the region along stream courses where water is present the year round.

Figure R-3-1 shows the relation of vegetation types to precipitation, elevation, and project location. This figure is a general representation of the conditions depicted, and is not intended to be precise for each specific project. Table R-3-9 shows typical plant communities found within the broad vegetation types; Table R-3-10 shows vegetation types which would be affected by the applicants' project components.

Based upon carrying capacity, the most productive vegetation type is riparian, followed by upland sage-grass, pinyon-juniper, mixed-desert shrub, and lastly the Bookcliffs woodland (BLM 1978b). These vegetative types comprise 98 percent of the area of influence. The remaining 2 percent is cropland and urban lands.

Complete listings of plant species located within the area of influence can be found in the BLM Vernal District Office; Soil Conservation Service, District Conservation Office in Vernal, Utah; and the Uintah and Ouray Indian Reservation Office in Fort Duchesne, Utah.

Vegetation Types

Riparian. The riparian type of vegetation occupies approximately 6,150 acres, which is less than 1 percent of the area of influence. Riparian communities are generally comprised of cottonwood trees, willow, salt cedar, greasewood, sagebrush, rabbitbrush, saltgrass, and a variety of annual and other perennial grasses and forbs that form a narrow fringe along the stream banks. This same species composition also can be found in the riparian zone of the greasewood-shadscale plant communities of the mixed-desert shrub type and the sagebrush community of the pinyon-juniper/mountain shrub type.

Mixed-Desert Shrub. The mixed-desert shrub type comprises 1,843,200 acres, or approximately 60 percent of the area of influence. Major shrub species include shadscale, winterfat, budsage, rabbitbrush, black sagebrush, and big sagebrush with a transition to juniper at the southern extension of this type. Common grasses are Indian ricegrass, Western wheatgrass, galleta, squirreltail, sand dropseed, and salina wildrye. Blue gramma and needle and thread grass are also found at the upper elevations. Forbs are generally scarlet globemallow and longleaf phlox, with the largest percentage of vegetation classified as other annuals (BLM 1981g).

Pinyon-Juniper. The pinyon-juniper type covers 806,400 acres comprising 26 percent of the area of influence. The type begins as a transition from the mixed-desert shrub type, through the Bookcliffs woodland type, as depicted in Figure R-3-1. Species composition changes with elevation, slope, and aspect. Juniper trees are the major species, with pinyon pine increasing with elevation and precipitation to a point where it dominates the upper extremes of the region. Common species include Utah juniper, pinyon pine, black sagebrush, birchleaf mountain mahogany, Mormon tea, and big sagebrush. Forbs are generally *Cryptantha* spp., *Eriogonum* spp., hairy golden aster, Indian paintbrush, and mat loco, plus other annuals. Grasses are salina wildrye,

TABLE R-3-9

PLANT COMMUNITIES WITHIN VEGETATION TYPES[a]

DESERT BIOME		WOODLAND BIOME		
Riparian	Mixed-Desert Shrub	Pinyon-Juniper	Upland Brush and Upland Sage-Grass[b]	Bookcliffs Woodland
Bottomland sagebrush	Rabbitbrush shrubland	Upland sagebrush	Sagebrush grassland	Mixed conifer
Greasewood shrubland	Upland sagebrush	Sagebrush grass	Serviceberry-Mountain mahogany	Pinyon-juniper
Cottonwood willow	Bottomland sagebrush shrubland	Artificial seeding	Oak (upland brush)	Upland brush
		Pinyon-juniper	Sprayed-upland sagebrush	Sagebrush
	Greasewood shrubland		Mixed conifer	
	Saltbrush shrubland		Pinyon-juniper	
	Shadscale shrubland			
	Barren land			

[a]Major vegetation type listed is a composite term used to give the reader a mental image of the vegetative cover. Plant communities have been identified and mapped by BLM and a site-specific analysis by Tosco, Paraho, Syntana-Utah, and Enercor-Mono Power.

[b]These types occur in the same area. Sage-grass is located on deeper soils of flat ridge tops, while the upland brush type is on the rocky and stony soils of the side slopes.

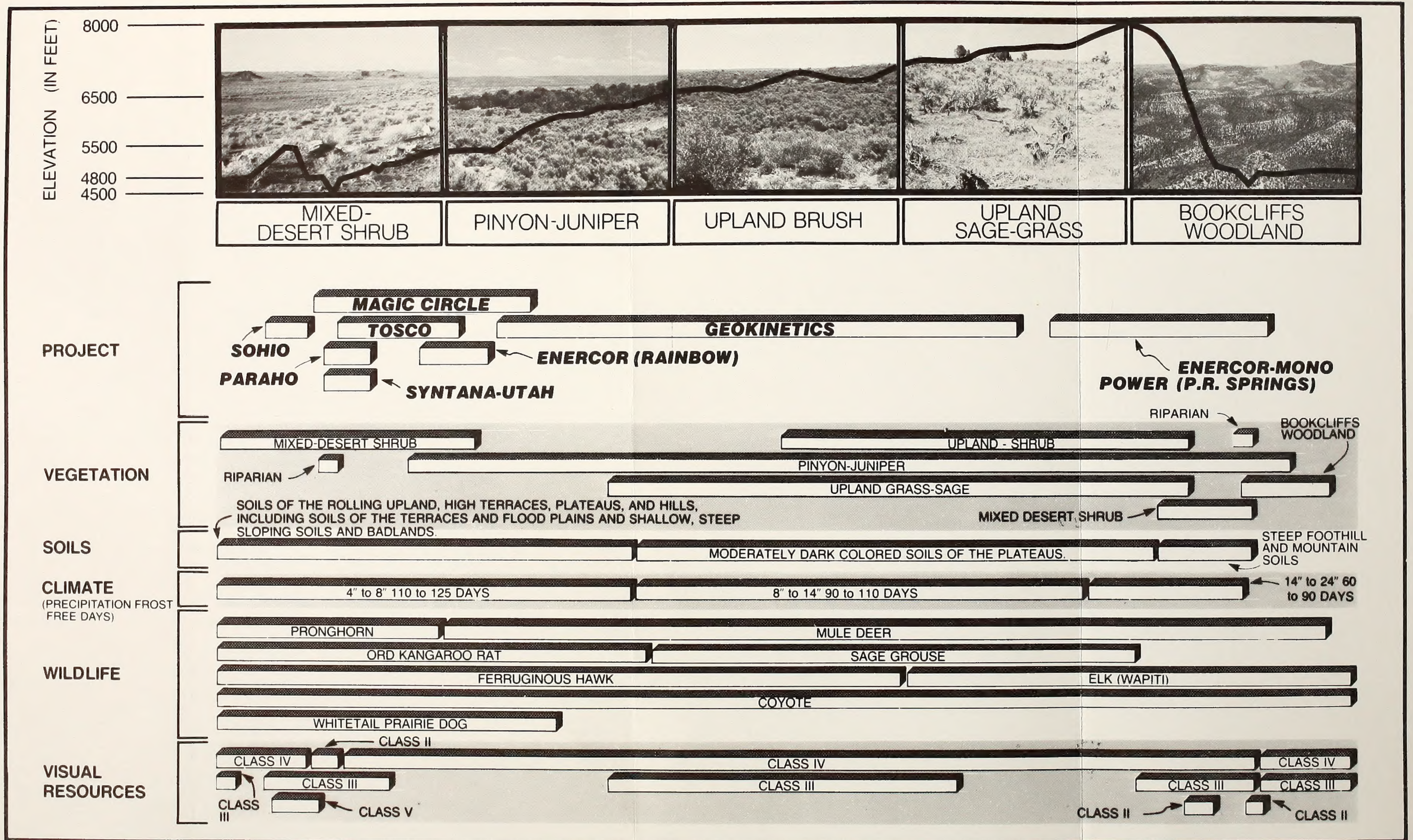


FIGURE R-3-1 INTERRELATIONSHIP OF PHYSIOGRAPHIC, CLIMATIC, BIOLOGIC AND VISUAL CONDITIONS

TABLE R-3-10

VEGETATION TYPES AFFECTED BY APPLICANTS' PROJECT COMPONENTS

COMPONENT	ENERCOR (RAINBOW)	ENERCOR-MONO POWER (P.R. SPRINGS)	GEOKINETICS	MAGIC CIRCLE	PARAHO	SOHIO	SYNTANA-UTAH	TOSCO
Plant and Facilities	PJ	UG	PJ	DS	DS	DS	DS	DS
Mined Area	PJ	US,UB	NA	NA	NA	DS	NA	NA
Spent Shale Disposal Area	PJ	NA	PJ	DS	DS	NA	DS	DS
Access Roads	PJ,DS	PF,DS	R,PJ,DS	R,DS	DS	DS	DS	R,DS
Water Pipeline	R,DS,PJ	PJ,DS	R,PJ,DS	R,DS	R,DS	R,DS	R,DS	R,DS
Product Pipeline	NA	DS,BW	R,PJ,DS	R,DS	DS	R,DS	R,DS	R,DS
Power Transmission Line	DS,PJ	DS,BW	R,PJ,DS	DS	DS	DS	DS	R,DS
Construction Camp	NA	DS	DS	NA	DS	NA	DS	NA
Natural Gas Pipeline	NA	NA	NA	NA	NA	NA	DS	NA

DS=Mixed-Desert Shrub; R=Riparian; PJ=Pinyon-Juniper; UB=Upland Brush; UG=Upland Sage-grass-Sage; BW=Bookcliffs Woodland; NA=Component not applicable to the project

bluebunch wheatgrass, galleta grass, Indian ricegrass, Western wheatgrass and blue grama grass.

Upland Brush Sage-Grass. The upland brush sage-grass type occupies 161,280 acres or 5 percent of the area of influence. It is comprised of several plant communities that are characteristic of the grassy ridge tops, brush-covered, stony side slopes, and tree-covered, steep drainages. Typical species are mountain big sagebrush, birchleaf mountain mahogany, Utah serviceberry, antelope bitterbrush, gambel oak, Oregon grape, and Utah juniper. Grasses are salina wildrye, bluegrass, bluebunch wheatgrass, sedges, and needle-and-thread grass. Forbs are generally buckwheat, pussytoes, phlox, lupine, and stickseed.

Bookcliffs Woodland. The Bookcliffs, a prominent eroded escarpment, covers 230,400 acres or 7 percent of the area of influence. It supports a sparse stand of juniper trees with a fringe of conifers and mountain brush. Primary species include juniper and pinyon trees with scattered Douglas fir and ponderosa pine at the upper extreme. Brush species are generally the same as those previously listed for the pinyon-juniper and upland brush-grass types. Grasses and forbs are the same as those found in the upland brush-grass and pinyon-juniper types but are sparse.

Threatened and Endangered Species

The Threatened and Endangered Species Act of 1973, as amended, through the U.S. Department of the Interior, Fish and Wildlife Service (FWS), has published a Notice of Review of Plant Taxa Native to the United States. This publication, as of December 15, 1980, identifies species in three categories. Category 1 are taxa for which the FWS has sufficient information for listing as endangered or threatened. Category 2 are taxa that have been proposed for listing but need additional biological data to determine status; these plants are not afforded protection under the Code of Federal Regulations but are protected by the land managing agency until final determination is made. Category 3 are taxa which are no longer being considered for listing.

The Category 1 and Category 2 plant species that have been located in the region, and could be affected by the applicants' proposed projects are listed below (Dudley 1981).

Category 1 - Sclerocactus glaucus (Uintah Basin hookless cactus), federally listed as threatened in Utah and Colorado.

Category 2 - Aquilegia barnebyi (no common name), Arabis spp. (rockcress), Astragalus chloodes (milk vetch grass), Astragalus hamiltonii (Hamilton milk vetch), Astragalus saurinus (dinosaur milk vetch), Cryptantha barnebyi (catseye barnebyi), Glaucocarpum suffrutescens (no common name), Gutierrezie sarothrae var. pomariensis (no common name), Penstemon goodrichii

(beardtongue), Penstemon grahamii (Graham beardtongue) and Thelypodiopsis argillacea (clay thelypodu), and Penstemon albafluvis (White River penstemon).

The State of Utah has not enacted legislation to protect plant species, although federal land managing agencies protect plant species listed in Category 2 by the FWS.

Soils

The area of influence includes a wide variety and complex combination of soils due to wide variations of geologic, topographic, climatic, and vegetation features. Soils within the region have been combined for analysis and evaluation into the following five generalized groups:

(1) Soils of the terraces and floodplains consist of deep, well-drained to somewhat poorly drained, loamy and sandy loam soils and are found on the nearly level to gently sloping terrace and floodplains of the White, Green and Colorado rivers, and the narrow, elongated, intermittent drainageways. These soils are formed in mixed loamy alluvium derived from sedimentary rock. They are subject to a slight to moderate erosion hazard, and in some areas, a moderate to strong saline and alkaline condition. They are the most productive soils of the area and are used for grazing and irrigated cropland, with alfalfa hay, small grains, and corn as the main crops grown.

(2) Soils of the rolling uplands high terraces and plateaus consist of shallow to deep, well-drained, loamy and sandy loam soils on sloping to rolling hills, convex ridges, and plateaus. These soils formed in mixed materials weathered from sedimentary rocks, with varying amounts of rock fragments on the surface and vary extremely in depth. The shallow and moderately deep soils are on steeper sloping areas have low productivity, are sparsely vegetated, and are subject to a moderate to high erosion hazard. These soils are used for limited livestock grazing and wildife habitat.

(3) Shallow, steep-sloping soils and rock outcrops. These are predominantly shallow to medium deep, well-drained, moderately alkaline, loamy and sandy loam soils found on moderately steep to very steep sideslopes and escarpments bordering intermittant drainageways and stream courses. They are very sparsely vegetated and subject to high runoff and high erosion hazard (geologic erosion). These soils are used mainly for watershed, wildife habitat, and very limited livestock grazing.

(4) Moderately dark colored soils of the plateaus and sideslopes in the higher precipitation areas are moderately deep and deep, well drained, neutral to moderately alkaline, loamy, and clay loam soils on gently sloping to sloping plateaus. These soils are subject to a slight to moderate erosion hazard. Shallow to moderately deep, loamy

soils on strongly sloping to moderately steep side slopes bordering the intermittent drainageways associated with a dendritic drainage pattern are also included in this group. These soils are used for livestock grazing and wildlife habitat.

(5) Soils of the Bookcliffs area are mainly shallow to deep, well-drained, neutral to mildly alkaline, loamy soils. They are on steep sloping mountain side slopes and canyon rims. Deep soils on toe slopes and on narrow elongated floodplains are included in this group. These soils are subject to landslides and moderate to high erosion hazards. They are used mainly for wildlife habitat, limited livestock grazing, and watershed.

Revegetation is difficult on most of the soils in the region, especially in the areas with less than 10 inches annual precipitation and on the steep sloping areas. Unfavorable soil properties, such as rock fragments on the surface, thin surface layers, moderate to strong alkalinity, and shallow depths, are very common in the region and would present problems for erosion control and revegetation. The most favorable areas for revegetation are the floodplains and terrace soils and the less-sloping plateau soils in the higher precipitation areas. Construction activities, mainly those associated with excavating would be difficult in areas of shallow soils underlain by hard bedrock (most commonly on crest slope and ridge positions) and areas of rock outcrop. The lack of unconsolidated soil material in these areas would require additional fill materials from outside sources to provide adequate bedding material for pipeline construction. (Refer to Figure R-3-1 for generalized location of soils in the area of influence.)

Detailed soil surveys have been made for most of the region (SCS and BLM 1981; SCS 1956; Tosco 1981). These soil surveys have been used to evaluate potential impacts and would be used by the applicants to determine applicable erosion control and revegetation measures.

R-3.A.5 WILDLIFE

Habitat Types

Primary habitat types found in the area of influence and descriptions of the various plant communities within each type are noted in Section R-3.A.4, Vegetation and Soils. Some of the wildlife species found in the area of influence and their occurrence by habitat (vegetative) type can be found in Figure R-3-1 and Table R-3-11).

Probably the most important wildlife habitat type found on an estimated 67,806 acres of the area of influence from the standpoint of animal diversity and numbers of individuals per acre is the riparian range type as classified by the Utah Division of Wildlife Resources (UDWR). (The UDWR classification is broader than that used in the vegetation section (R-3.A.4).) This type makes up less than 1 percent of the area of influence. The importance of this habitat type to wildlife cannot be over emphasized, however, even though it forms only a very small portion of the total wildlife habitat available. In

TABLE R-3-11

SELECTED TERRESTRIAL AND AQUATIC SPECIES AND THEIR PREFERRED HABITATS[a]

Species	Project[c]	Habitat Type[b]					
		Riparian	Mixed-Desert Shrub	Pinyon-Juniper	Upland Sagebrush/ Grass	Bookcliffs Woodland	Aquatic
Endangered or Threatened: Federal List							
Black-footed Ferret	All (because of extended ROW's)		X				
Bald Eagle	E,M,P,S,T,G-A,PR,G-L	X - Wide ranging raptor which may occur in lowland habitats during winter					
American Peregrin Falcon	All	X		X	X	X	X
Whooping Crane	All	X - Migrating in company of sandhill cranes					
Colorado Squawfish	T,G-A,SO						X
Humpback Chub	T,G-A,SO						X
Bonytail Chub	T,G-A,SO						X
State of Utah: Declining Population							
Razorback Sucker							X
Big Game							
Mule Deer	All	X	X	X	X	X	
Pronghorn Antelope	E,M,P,S,T,G-A,PR,G-L		X				
Wapiti (elk)	P-R				X	X	
Black Bear	P-R				X	X	
Mountain Lion	P-R					X	
Small Mammals							
Desert Cottontail Rabbit	All	X	X	X	X	X	
Ord Kangaroo Rat	E,M,P,S,T,G-A,SO,G-L	X	X	X			
Whitetail Prairie Dog	All (because of extended ROW's)		X				
Uinta Ground Squirrel	All	X	X	X	X	X	
Deer Mouse	All	X	X	X	X	X	
Coyote	All	X	X	X	X	X	
Least Chipmunk	All		X	X	X	X	
Birds							
Sage Grouse	P-R				X		
Blue Grouse	P-R					X	
Mourning Dove	All	X	X	X	X		
Golden Eagle	All	X	X	X	X	X	X
Brewers Sparrow	E,G-A,G-L,PR		X		X		
Sage Thrasher	E,G-A,G-L,PR				X		
Green-tailed Towhee	E,G-A,G-L,PR			X	X		
Horned Lark	E,M,P,S,T,G-A,G-L		X	X			
Ferruginous Hawk	E,M,P,S,T,G-L,G-L	X	X				

[a]Preferred habitats by species taken based on UDWR. 1981. Vertebrate wildlife species of Utah. Compiled by: Earl A. Sparks. Utah Division of Wildlife Resources Pub. No. 81-2. Salt Lake City, Utah.

[b]Refer to Vegetation, Soils and Reclamation section, R-3.A.4, for a description of the various vegetative types.

[c]E-Enercor (Rainbow); M-Magic Circle; P-Paraho; S-Syntana-Utah; T-Tosco; G-A-Geokinetics, Agency Draw; SO-Sohio; PR-Enercor-Mono Power (P.R. Springs); G-L-Geokinetics (Lofreco).

fact, studies in the mountainous West (Thomas et al. 1978) indicate that the habitat types important to wildlife species is much greater than its frequency in the area would indicate. In this semi-arid area, the riparian type is extremely important as a fawning area and critical summer range for mule deer.

The mixed-desert shrub habitat type covers an estimated 1,843,200 acres or about 59 percent of the region. This type furnishes year-round range for pronghorn and small rodents, predators and birds, plus some high priority deer winter range. It also furnishes hunting and nesting habitat for several species of raptors.

Pinyon-juniper habitat occurs on an estimated 806,400 acres or about 26 percent of the region. This type is important to many species of birds, furnishes important deer winter range, and provides a home to several species of predators which prey on the many species of small mammals found there.

The upland brush sage-grass habitat type is found on an estimated 161,280 acres or about 5 percent of the area of influence. This is an interspersed type, which furnishes food and cover on a year-round basis to mule deer, many small animals, predators, and birds. It is very important from the standpoint of furnishing forage diversity for the grazing and browsing wildlife species.

The Bookcliffs woodlands occupy the steeply eroded escarpment on the southern end of the area and cover an estimated 230,400 acres or 7 percent of the study area. This type is occupied by several big game species, large predators, many rodents, and small birds and furnishes winter cover in its lower elevations.

The aquatic environment in the region consists of about 400 miles of classified warmwater streams and rivers, 58 miles of classified coldwater streams, 920 acres of warmwater lakes, and about 2,140 acres of coldwater lakes (UDWR 1981). There are also an unknown number of miles of small flowing streams and intermittant small tributaries which may not support any fish life.

Habitat types that would be affected by individual site-specific projects are identified in the second part of this EIS. Habitat types for the conceptual projects are discussed below.

The Enercor-Mono Power P.R. Springs project has about 3,200 acres of high priority deer winter range located on the southern end of the lease area and about 5,760 acres of critical value deer summer range on the northern portion of the lease area. Deer generally occupy the high priority winter range area from November 1 through May 15, while the summer range is inhabited by deer from May 15 to October 31. There are approximately 6,080 acres of critical elk winter range and about 2,880 aces of high priority elk summer range located on the lease area. The elk are on their winter ranges from about November 1 through May 15 and on the summer ranges from May 15 to August 15.

High priority sage grouse summer range is found on about 2,990 acres of the lease area and about 5,970 acres of substantial value yearlong sage grouse range is also located on the area. There are also two strutting grounds located in the immediate vicinity of the lease area, but not on the area itself. The entire lease area of some 8,960 acres is classified by Utah Division of Wildlife Resources as substantial value yearlong blue grouse habitat.

The Geokinetics Agency Draw project has about 2,560 acres of critical deer winter range and about 19,440 acres of high priority deer winter range located on the leased area. There are also about 960 acres of limited value elk winter range found along the southern edge of the area. The entire lease area of about 22,000 acres is classified as substantial value sage grouse yearlong range by the Utah Division of Wildlife Resources.

The 11 sections planned for the Lofreco process (7,040 acres) are located in about 3,640 acres of high priority deer winter range, 480 acres of critical deer winter range and about 2,560 acres of limited value deer yearlong range. There are also about 1,280 acres of limited value elk winter range on two of the areas. All 11 of the sections are located in substantial value yearlong sage grouse range (7,040 acres).

The Sohio Asphalt Ridge project lies entirely in an area of limited value, yearlong, mule deer range. Also, an area of about 90,147 acres of high priority value, yearlong, pronghorn range is located immediately to the west of the project area. Sage grouse habitat classified as substantial value yearlong range for these birds is also found to the west of the project area. Two strutting grounds (leks) are found in this area, one of which has some associated nesting habitat located on the extreme southwestern portion of the project area. The sage grouse habitat in this area totals an estimated 118,721 acres (UDWR 1982).

Terrestrial Wildlife

Mammals

Total estimated acres of classified big game habitat in the area of influence is shown in Table R-3-12. These acreages were calculated from big game range maps furnished by the Utah Division of Wildlife Resources (1981d).

The monetary value of the wildlife resources to the region is considerable and is in addition to the license monies that support the wildlife management programs of the state. See Section R-3.A-1, Socioeconomics, for an analysis of the importance of these monies to the local economy. The current estimated harvest numbers for all species are at levels that should allow the regional populations to increase. Table R-3-13 presents hunting, fishing, and economic data for major species and groups of species in Uintah County, Utah. No data is presented in this table concerning Colorado, as significantly affected areas are anticipated to located mainly in Utah. Hunting success rates and the number of days spent hunting and fishing in Uintah County are discussed in Section R-3.A.8, Recreation.

TABLE R-3-12

ACRES OF CLASSIFIED BIG GAME HABITAT IN THE AREA OF INFLUENCE[a]

Habitat Type[b]	Deer	Elk	Pronghorn Antelope
Critical Winter Range	354,600	269,568	NA
High Priority Winter Range	852,687	239,616	NA
Limited Value Winter Range	NA	133,632	NA
Critical Summer Range	423,014	NA	NA
High Priority Summer Range	NA	393,984	NA
Substantial Value Summer Range	8,755	NA	NA
High Priority Yearlong Range	NA	NA	346,199
Substantial Value Yearlong Range	NA	NA	52,923
Limited Value Yearlong Range	638,208	NA	93,773
Riparian Range[c]	67,806	NA	NA
TOTAL	2,318,560	1,036,800	492,895

NA = not applicable

[a]Some of these ranges overlap. Therefore, there may appear to be more total acres indicated on the table than actually exist on the ground.

[b]Classification of habitat types from the Utah Division of Wildlife Resources Map Overlay Display System.

[c]This type is also classified as High Priority Yearlong Range for deer in the Utah Department of Wildlife Resources classification system.

TABLE R-3-13

SUMMARY OF UINTAH COUNTY HUNTING AND FISHING DATA (1976-1980)[a]

	Total Participants	Number of Animals Harvested[b]	5-year Total Expenditures
Upland Game	45,037	293,130	$4,150,714
Waterfowl	2,132	16,583	$ 145,725
Big Game			
Mule Deer	28,841	9,117	$7,240,479
Elk	12,175	1,346	$4,812,282
Black Bear	157	47	$ 48,663
Cougar	56	36	$ 100,920
Pronghorn Antelope	194	156	$ 20,176
Coldwater Fish[c]	5,794	NA	$1,237,219
Warmwater Fish[d]	4,455	NA	$ 940,058

[a]The data for this table was derived from various reports developed by the Utah Division of Wildlife Resources for the 1976-1980 period (UDWR 1976-1981).

[b]Includes 11 species of upland game.

[c]Data based only on East Park Reservoir 1981 survey (UDWR 1982) and Steinaker Reservoir 1976 survey (UDWR 1982).

[d]Data based only on Pelican Lake 1977 survey (UDWR 1982).

Numbers of mule deer utilizing these ranges have not completely recovered from the severe declines of the late 1960's and 1970's. Estimates of the regional mule deer population indicate that numbers are low but stable to slightly decreasing at the present time (Crannie 1981). In spite of the present low population level, the mule deer is a very important trophy and game species in the area of influence. In addition to its trophy value, the mule deer is of significant importance to the area because of the number of hunters who come in to the area, the numbers of animals harvested, and the amount of income to the area that is generated by the mule deer resource. In addition to the food value of the harvested animals (about 911,700 pounds of meat), deer hunters spent an estimated $7,240,479 during the 1976-1980 period in pursuit of their sport (Table R-3-13), which was an economic boost to Uintah County.

The size of the elk herds occupying the seasonal ranges of the area are thought to be stable to slightly increasing (Crannie 1981). In the 5-year period from 1976 to 1980, elk hunters spent about $4,812,282 in Uintah County (Table R-3-13).

While not as numerous as deer or elk, the pronghorn antelope is an important big game animal in Uintah County. From 1976 to 1980, hunters spent an estimated $20,176 pursuing pronghorns in the county (Table R-3-13). Regional animal population levels are thought to be stable to slighty decreasing (Crannie 1981).

Black bear and cougar are also found in some of the more remote areas of Uintah County, and both of these species furnish considerable sport and economic return. During the 1976 to 1980 period, estimated expenditures by bear hunters total $48,663, while cougar hunters spent about $100,920 during the same period. The 56 hunters spent about 330 days hunting (Table R-3-13).

There are two subspecies of cottontail rabbits found within the region; the mountain cottontail is found in the sagebrush and mountain shrub areas and the desert cottontail is found in the more open mixed-desert shrub areas. These two subspecies furnish considerable hunting sport for many people as evidenced by the estimated $1,553,295 spent by rabbit hunters.

A large variety of furbearers, predators, and numerous small mammals can be found in the area. There are at least 55 species of small mammals that could occur in Uintah County (UDWR 1981a).

Birds

From the standpoint of harvest and hunter effort, the ring-necked pheasant, sage grouse and the mourning dove are the major game birds found in the area of influence. The pheasant is found only in the agricultural areas around Vernal, Jensen, Randlett, Myton, and Roosevelt and inhabits an estimated 87,215 acres of irrigated croplands in these areas. Upland game hunters spent an estimated $4,150,714 in Uintah County during the 5-year period (Table R-3-13).

Ducks and geese found in the area are mostly migratory; and, during the spring and fall migrations, many water areas in the region are used for resting. Some waterfowl nesting occurs in rivers, streams, reservoirs, and stock ponds, but the area cannot be classified as a high waterfowl production area.

There are an estimated 200 species of nongame birds found in the Uintah County area (UDWR 1981a). These birds are found throughout the area in suitable habitats. In addition, abundant raptor nesting and hunting habitat can be found in the area. Large concentrations of both bald and golden eagles can be found in the area during the winter. The golden eagle is listed as neither rare nor endangered, but is included under the Bald Eagle Act, which provides for its protection. Several active nests of the golden eagle are known to occur near some of the site-specific project areas that are considered in this EIS.

Reptiles and Amphibians

The area of influence does not have a great number of reptiles, although there are about 18 species found in the Uintah County area. Because of the semi-arid nature of this area, amphibian numbers are relatively low; approximately seven species occur within the region (Stebbins 1966; UDWR 1981a).

Aquatic Wildlife

The coldwater streams in Uintah County support a sport fishery consisting of brown, rainbow, brook, and cutthroat trout in suitable habitat. Coldwater lakes in the area mainly support rainbow, brook, and cutthroat and brown trout sport fishing. Warmwater species sought after in stream habitat include channel catfish and walleye. Other warmwater species are found in very limited numbers.

Pelican Lake supports a bluegill/bass fishery that is of very high regional significance and is recognized nationally.

The Utah Division of Wildlife estimates that during the 1976-1980 period $1,237,219 was spent by coldwater fishermen, and $940,058 was spent by warmwater fishermen in Uintah County (Table R-3-13). These figures do not include data from the Uintah and Ouray Indian Reservation. It is estimated that 11,335 special non-Indian fishing permits were sold on the reservation during the same 5-year period (Cuch 1982). The monetary value of the fishery resource to Uintah County is considerable and is in addition to license monies that support fisheries management programs.

In 1980, an estimated 20,522 persons lived in Uintah County (Table R-3-1). If data presented in Allred (1976) remains constant, approximately 30 percent of these persons will be involved in nonconsumptive uses of the wildlife resources of the county. It is also estimated that nonconsumptive users would spend about $87.40 each in pursuit of birdwatching and general wildlife observation trips, spending a minimum of $538,034 (1980 dollars) in the county.

The total estimated minimum value of consumptive and nonconsumptive uses of the wildlife resource in Uintah County in 1980 dollars is $19,235,270 per year.

Threatened or Endangered Species

Since there are known colonies of whitetail prairie dogs found in Uintah County, habitat exists for the black-footed ferret. Historically, this endangered animal ranged into northeastern Utah (Hall and Kelson 1959; Gates 1973) and could still exist here. Intensive searches for ferrets must be undertaken on all prairie dog colonies affected by project construction activities.

Bald eagles winter in large numbers along the White and Green rivers and on Pelican Lake during December, January, and February. However, no bald eagles are known to nest in Uintah County (UDWR 1981a).

The endangered peregrine falcon is known to nest in Dinosaur National Monument, and these birds could range over the entire region. On several occasions, the federally listed whooping crane has been observed migrating over Uintah County, usually in the company of sandhill cranes. These birds could rest in this area.

Three endangered fish species have been found in the White and Green rivers--the Colorado squawfish (*Ptychocheilus lucius*), the humpback chub (*Gila cypha*), and the bonytail chub (*Gila elegans*).

The Colorado squawfish has been reported in small populations in the White River (FWS 1982). These fish apparently gain access to the White River from the Green River (Lanigan and Berry 1979). They have been known to travel considerable distances up tributary streams and could be encountered in the White River.

Although there has been no Colorado squawfish spawning documented in the White River, there is a potential spawning site about 15 miles west (downstream) of the proposed White River Dam at river milepost 34. This area is presently being monitored by the Utah Division of Wildlife Resources (UDWR 1982).

The humpback chub is native to the Colorado River system and is adapted to swift water habitats. The only major populations of this fish known to conclusively exist in the upper Colorado River basin are located in the Westwater Canyon and Black Rocks area on the main Colorado River. There have been incidential collections from Cataract Canyon and Gray and Desolation canyons on the Green River (FWS 1982). Since this fish has occurred in the Green River, it could occur in the White River.

Bonytail chubs have apparently not been collected from the White River, as their habitat preferences are for larger rivers and fairly swift currents. However, since this fish has definitely been collected from the Green River, it could migrate and therefore occur in the White River.

The razorback sucker (Xyrauchen texanus) is a sensitive species with potential for threated or endangered status. Since this fish has been collected from the Green River in the vicinity of its confluence with the White, it could also occur in the White River.

R-3.A.6 AGRICULTURE

Cropland

Approximately 89,810 acres of cropland occurs in the area of influence. Main cropland areas are located in the Ashley Valley (Vernal-Jensen), Pelican Lake, Roosevelt, and Rangely areas. Smaller areas of cropland occur on the floodplains of the White, Duchesne and Green rivers near Ouray on the floodplains of the Colorado River near Westwater, and on floodplains along Willow Creek, Hill Creek, Main Canyon, Bitter Creek, and Evacuation Creek in Uintah County, and in Colorado.

Crop production is almost entirely dependent on irrigation, as annual rainfall ranges from 6 to 10 inches over most of the area. Most of the area is surface irrigated except for some sprinkler irrigation mainly in the Pelican Lake area.

The principal type of farming in the area of influence is the production of livestock feed. Main crops include alfalfa hay, small grains (barley and oats), corn for silage, and pasture and meadow hay. The principal crop is alfalfa hay which is grown on about 65 percent of the cropland. Small grains, corn, and meadow hay are grown on about 30 percent of the area (SCS 1970; SCS 1981a).

The average per acre yields for the areas principal crops are 3.9 tons of alfalfa hay, 1.8 tons of meadow hay, 73 bushels of barley, 61 bushels of oats, and 19 tons of corn for silage (SCS 1981a; State of Utah 1981). Crop production is often limited by the availablity of irrigation water.

Prime agricultural land occurs on the nearly level terrace and floodplains of the larger streams and tributaries. Approximately 30 percent of the irrigated cropland is identified as prime agricultural land (SCS 1981a).

Livestock Grazing

Livestock grazing is authorized on all state and federal lands that would be crossed by the applicants' proposed projects. The BLM has established grazing allotments and the Bureau of Indian Affairs (BIA) has established range units, which are legal parcels of land for which grazing privileges are authorized. These allotments and range units may include lands administered by other federal and state agencies and private lands. Where this occurs on BLM allotments, the landowner or administrator may sign an agreement authorizing the BLM to establish the grazing seasons and manage the vegetation. This ensures uniform grazing practices and eliminates the need for fencing individual ownerships.

There are 88,000 animal unit months (AUMs) authorized on 1,300,000 acres of land in the area affected by the proposed projects. Grazing animals include 70,000 sheep, 12,000 cattle, and 49 horses, and approximately 100 wild and free-roaming horses (BLM 1981b). (State-leased land, private land, federal land, and Indian grazing range unit data are incorporated in these figures.)

R-3.A.7 TRANSPORTATION NETWORKS

The information included in this section is summarized from the Socioeconomics Technical Report (State of Utah 1982b). For more details on the transportation networks in the area of influence, refer to the technical report.

Highways

The road network within the area of influence consists of many differing roads ranging from an Interstate Highway (I-70) to a two-lane principal arterial (U.S. 40) to primitive dirt roads. Much of the interior of the area is dominated by dirt roads. The majority of the paved roads are located in the northern portion of the area, except for I-70, which borders the southern edge.

Five major roads carry the majority of the traffic (Map R-A-1, located in Appendix R-A). These roads are I-70, U.S. 40, State Route (SR) 88, SR 45 and Colorado 64. Construction is underway on a new road that will provide a direct link from Vernal, Utah to Bonanza, Utah. This is designated as County Road "A" on Map R-A-1, located in Appendix R-A.

There are two other noted local county roads in the area, county roads 262 and 264. Most of County Road 264 is located on the Uintah and Ouray Indian Reservation. Another local road exists between Bonanza and Colorado 64. All these roads are narrow with no shoulder and poor sight distance, and the paved surfaces are in poor condition. There are other roads within the area, but they are dirt roads or surfaced with "native asphalt."

All of the major transportation links that cross the Uintah and Ouray Indian Reservation are maintained by the State of Utah. They include U.S. 40, SR 88, and County Road 264. There are many other roads within the reservation including unpaved roads that are maintained by BIA and the Ute Tribe. These roads would not be able to support substantial increases in traffic due to their poor structural condition and low operating speeds.

All of the major Utah state roads in the project area are in need of some form of resurfacing, increased shoulder width, or additional leases for safety (Van Wagoner 1980). Truck traffic is exceeding twenty percent of the traffic volume on U.S. 40 and SR 45. The accident rate ranges from 2.42 to 2.90 per million miles on SR 88 and U.S. 40. Projected baseline traffic volumes and levels of service are shown in Table R-3-14.

TABLE R-3-14

PROJECTED BASELINE AVERAGE ANNUAL DAILY TRAFFIC
AND LEVEL OF SERVICE

Highway Link	Number of Vehicles 1985	1995	Level of Service[a] 1985	1995
US 40				
County line to County Road 264	5,440	6,517	C	D
County Road 264 to SR 88	3,706	4,441	B	C
SR 88 to Vernal	3,955	4,739	C	C
Vernal to Jensen	5,356	6,542	C	D
Jensen to SR 45	2,348	2,868	B	B
SR 45 to Utah/Colorado border	1,975	2,412	B	B
I-70				
SR 163 to Utah/Colorado border	4,175	6,801	A	A
SR 88				
U.S. 40 to County Road 264	364	466	A	A
County Road 264 South	419	537	A	A
New Road "C"	-----	-----	--	--
SR 45				
Northern	315	403	A	A
Southern	331	424	A	A
New Road "D"	-----	-----	--	--
Colorado 64				
Dinosaur to Rangely	4,077	4,980	C	C
New Road "A"				
Vernal to SR 45	-----	-----	--	--

[a]American Association of State Highway and Transportation Officals (1965) Levels of Service. A = free traffic flow, accompanied by low volumes and high speeds; B = stable traffic flow, with operating speeds beginning to be restricted by traffic conditions; C = stable traffic flow, but drivers are restricted in their freedom to select speed, change lanes, or pass; D = approaches unstable traffic flow, with fluctuations in volume and temporary restrictions to flow, which may cause substantial drops in operating speeds; E = unstable traffic flow, with monentary stoppages; F = forced traffic flow, with low speeds and short or long stoppages because of downstream congestion.

Air Network

There are presently four airports within or near the area of influence. They are located at Duchesne, Roosevelt, Vernal and Green River.

The Utah: 2000 - A High Development Scenario prepared by the Utah Office of the State Planning Coordinator (1980) indicates that the four airports have a total of 44,100 operations (take offs and landings) per year. Vernal airport had the most traffic in 1981 with 27,000 operations. Vernal is served by two commuter airlines.

Rail Network

There are currently no rail services in the Uintah Basin. The closest railheads are 120 miles or more from the synfuel project sites. The Union Pacific goes through Salt Lake City, where equipment and supplies would have to be unloaded and trucked to the Uintah Basin via U.S. 40. The Denver and Rio Grande Western Railroads (D&RGW) are located west, south and east of the Uintah Basin with railheads at Helper, Utah; Mack and Craig, Colorado. Mack would be the most convenient unloading site for truck haul from the D&RGW to the synfuel projects via Colorado 138 to U.S. 40.

Public Bus Transportation

Public transportation in the Uintah Basin is operated by two private companies, Continental Trailways and Wilkins Transportation Company. Local public transportation for the elderly and handicapped is operated through the Uintah Basin Association of Governments.

The Ute Indian Tribe operates two mini-buses for pubic transportation within the reservation.

R-3.A.8 RECREATION

According to a survey of Uintah Basin residents conducted by the Institute of Outdoor Recreation and Tourism at Utah State University, the five most frequently engaged in outdoor recreation activities (in order of preference) are fishing, driving for pleasure, camping, big game hunting, and swimming.

Due to the high percentage of federal land, the vast majority of the area of influence is used for dispersed outdoor recreation such as off-road vehicle (ORV) use on designated or existing vehicle routes, dispersed camping, and day use activities. Table R-3-15 identifies those recreation areas within a secondary zone of influence, defined as the area within a 2-hour driving time from Vernal, Roosevelt, or Westwater, Utah, or Rangely, Colorado, which is the maximum distance that most people are willing to drive for weekend outdoor recreation. These communities were chosen because the majority of the proposed synfuel development work force and support personnel are expected to

TABLE R-3-15

RECREATION ATTRACTIONS WITHIN SECONDARY ZONE OF INFLUENCE

Administering Agency	Site	Attraction (Special Values)	Location
National Park Service	Dinosaur National Monument	Fossil excavations, camping, hiking, trails, river rafting.	NE Utah, NW Colorado
	Colorado National Monument	Unique geologic features, camping scenic areas, hiking.	Grand Junction, Colorado
	Arches National Park	Unique natural sandstone arches, windows, spires, and pinnacles, camping, hiking trails.	Moab, Utah; SE Utah
U.S. Forest Service	Ashley National Forest	Flaming Gorge National Recreation Area, High Uintas Wilderness Area (proposed) Drive Through the Ages, Sheep Creek Canyon Geologic Area, camping, hiking, hunting, boating, river rafting, fishing, snowmobiling.	NE Utah
	White River National Forest	Flat Tops Wilderness Area, Trappers Lake, hiking, camping, hunting, fishing.	NW Colorado
	Grand Mesa National Forest	Hiking, camping, hunting, fishing.	NW Colorado
U.S. Fish and Wildlife Service	Ouray National Wildlife Refuge	Waterfowl hunting, hiking, waterfowl observation.	E Central Utah
	Brown's Park National Wildlife Refuge	Waterfowl hunting, hiking, waterfowl observation.	NE Utah
Bureau of Land Management	Desolation and Gray Canyons--Green River	River rafting.	E Central Utah
	Westwater Canyon--Colorado	River rafting.	E Central Utah
Bureau of Reclamation	Red Fleet Reservoir	Developed campground, boat ramp, boating and sailing, and fishing.	N of Vernal, Utah
Ute Indian Tribe	Bottle Hollow Reservoir and Resort	Developed campground, boating and sailing, and fishing.	W of Vernal, Utah
State of Utah	Steinaker Lake State Recreation Area	Steinaker Reservoir, camping, boating, fishing.	NE Utah
	Stewart Lake Waterfowl Management Area	Waterfowl hunting.	S of Jensen, Utah
	Big Sand Lake State Beach	Big Sand Lake, swimming, boating, fishing, camping.	NE Utah
	Starvation Lake State Beach	Starvation Lake, swimming, boating, fishing, camping.	NE Utah
	Dead Horse Point State Park	Unique geological formations, scenic views, camping, hiking, trails.	Moab, Utah
	Pelican Lake	Fishing, boating.	NE Utah

TABLE R-3-15 (Concluded)

RECREATION ATTRACTIONS WITHIN SECONDARY ZONE OF INFLUENCE

Administering Agency	Site	Attraction (Special Values)	Location
State of Colorado	Highline State Park	Scenic views, camping, boating, swimming.	Loma, Colorado
	Island Acres State Park	Rock climbing, swimming, camping.	Grand Junction, Colorado
	Rifle Gap Falls State Park	Camping, hiking, rock climbing, boating, fishing.	Rifle, Colorado
	Vega State Recreation Area	Camping, hiking, boating, fishing.	Rifle, Colorado
	Rio Blanco Lake State Fishing and Wildlife Area	Camping, fishing, hunting.	Rangely, Colorado
	Lake Avery State Fishing Area	Fishing, camping, boating.	Rifle, Colorado

live there, particularly in Vernal where a wide range of amenities and services are offered.

Due to lack of information, baseline projections on recreation within the Uintah and Ouray Indian Reservation cannot be made.

Visitor Use Data

BLM's Vernal District Office estimates that approximately 75 percent of the visitor use on public lands administered by BLM within the Bookcliffs Resource Area is local and 25 percent is nonlocal or out-of-state (BLM 1973b). Data collected in 1981 estimates visitor use to be 1,424 visitor days for 3,468 visits within the approximate 654,000-acre Seep Ridge Planning Unit (located south of the White River in Uintah County), and 2,639 visitor days for 7,575 visits within the approximate 377,000-acre Bonanza Planning Unit (located north of the White River in Uintah County) (Smith 1982).

The 1981 projected visitation for Dinosaur and Colorado National Monuments, and Arches National Park was 366,155; 775,582; and 326,508; respectively. These are projected to increase to 439,229; 870,000; and 412,693; respectively, by 1983 (NPS 1981). The visitation projections for 1982 and 1983 are based on a 3-year linear projection that does not include the anticipated population growth from new energy development within the area (Galapo 1981).

The Ashley National Forest, located 17 miles north of Vernal, Utah, includes the Flaming Gorge National Recreation Area and the proposed High Uintas Wilderness Area. The 1980 recreational use was 1,579,400 visitor days in the Ashley National Forest.

Water-Oriented Activities

There are several rivers and lakes within the secondary zone of influence that are important to the public for water-oriented recreation opportunities. These include the White, Green, Colorado, Dolores, and Yampa rivers and the Pelican and Big Sand lakes, and Steinaker, Red Fleet, Flaming Gorge, and Starvation reservoirs. where boating and fishing can be enjoyed. Additionally, fishing opportunities in over 400 lakes and streams in the Uinta Mountains are also popular.

Three rivers of national significance (White, Green, and Colorado rivers) occur in the area of influence. The White River was nominated for consideration as a National Wild and Scenic River by the State of Colorado in 1975. Because the U.S. Congress decided not to amend the Wild and Scenic Rivers Act to include the White River in the National Wild and Scenic River System, the nomination became void by ruling of the Secretary of the Interior. Subsequently the White River from the Colorado-Utah state line to its confluence with the Green has been identified as an Inventory River Segment which meets the criteria for study for inclusion in the National Wild and Scenic Rivers System (NPS 1982). (The National Park Service determined

that the Inventory River Segment of the White River met the free-flowing criteria and possessed recreational and fish and wildlife values that may be of national significance.) Initiation of study would require specific designation by Congress or applications by the Governor(s) of the state(s) concerned for inclusion in the system. Since Congress has not designated the White River for study nor has the Governor of Utah applied to have the river included in the system under provisions of the Wild and Scenic Rivers Act, the protection afforded by this Act does not apply (NPS 1982).

Other restrictions to development along the White and Green rivers are identified in Section R-3.A.14, Existing Land Use Plans.

Additional river segments within the region identified under the Nationwide Rivers Inventory include the Green River (Range Creek to the Yampa River directly) and Yampa River (Little Snake River to Williams Fork).

The Colorado River, from its confluence with the Dolores River, Utah, upstream to a point 19.5 miles from the Utah-Colorado border in Colorado, is part of a 56-mile segment that has been recommended for inclusion in the National Wild and Scenic River System (NPS 1979). This recommendation is pending further Congressional action.

Additionally, both the Green River in Colorado, from the Dinosaur National Monument to the confluence with the Yampa River, and the Yampa River in Colorado have had studies completed with recommendations for inclusion into the Wild and Scenic River System.

The Green River through Desolation and Gray canyons and through Dinosaur National Monument; the Colorado River through Westwater Canyon; and the Yampa River in Colorado offer excellent white-water river running. The BLM and NPS authorize river trips through these canyons using a permit system for commercial and noncommercial users. Approximately 10,000 passenger days were spent floating through the Westwater Canyon from May 1 to September 30, 1981 (Packer 1981).

Steinaker, Red Fleet, Big Sand, Bottle Hollow, and Starvation lakes in Utah and Highline and Rifle Gap reservoirs in Colorado are particularly noted for their boating, sailing, and fishing opportunities. Pelican Lake, which is approximately 25 miles southwest of Vernal, Utah, has been called the best bluegill lake in Utah (Burdick 1979). It is fished yearlong and from 1973 to 1977 averaged 7,700 angler days per year (Burdick 1979). Coldwater fishing is also popular on the Bottle Hollow Reservoir, located on the Uintah and Ouray Indian Reservation. Some 2,703 permits were issued by the Ute Indians in 1980 (Uintah and Ouray Agency 1982). Table R-3-16 provides coldwater and warmwater fishing data for Uintah County for 1980.

Land-Oriented Activities

Within the regional secondary zone of influence, the primary land-oriented recreation opportunities are hunting, off-road vehicle (ORV) use, camping, and hiking.

Table R-3-16 depicts the hunter days of use for mule deer, pronghorn antelope, elk, and small game within Uintah County in 1980. The proposed High Uintas Wilderness Area, north of Vernal, Utah, and the Flat Tops Wilderness Area, north of Rifle, Colorado, have traditionally provided high quality elk and deer hunting experiences. Antelope, elk, and deer hunting also occur in the Bookcliff area. Waterfowl hunting opportunities for pheasant, ducks, and geese occur along the lowlands and river drainages. Hunting for mule deer within the Ouray National Wildlife Refuge tripled from approximately 200 hunter days to 600 hunter days from 1980 to 1981 (Troester 1982).

The secondary zone of influence includes three national forests, three National Park Service units, and four state parks in Utah, and six state parks in Colorado where camping and hiking opportunities are plentiful. The Bottle Hollow resort, owned and operated by the Ute Indians, is the largest privately owned recreation facility in the region; it includes 90 campsite units.

Municipal and County Recreation Opportunities

Vernal and Roosevelt, Utah, and Grand Junction and Rangely, Colorado, have active municipal recreation programs. Approximately four years ago, Vernal constructed a year-round covered swimming facility. No community recreation centers exist in Vernal today (Bloxham 1982). Roosevelt has two existing park areas (one of which is a regional park having 4 softball diamands and a day use picnic area), a 9-hole golf course, and one 25 year old outdoor swimming pool that is in constant need of repair. No community recreation center exists in Roosevelt (Eschler 1982). Rangely has one community recreation center, one year-round swimming facility, one park area (Elks Park), a camper park containing 30 sites, an open space park (Riveside Park) and several tennis courts. Additionally, the new Master Plan for the city has proposed several new facilities, including an 18-hole golf course, a 40-acre park, 2 more softball diamonds across from the rodeo grounds, and several ovenight and day-use facilities associated with the proposed Taylor Draw Reservoir Project (Bartlett 1982). Grand Junction has an assortment of recreation and park facilities and areas typically found in a large community of its size.

R-3.A.9 WILDERNESS

This analysis inventories Wilderness Areas and areas under formal wilderness review, study, or appeal (having the potential for future Wilderness designation by Congress) within an established secondary influence zone (Section R-3.A-8, Recreation).

Under the Wilderness Act of 1964 (Public Law 88-577) and the Federal Land Policy and Management Act of 1976 (Public Law 94-579), only the U.S. Cqngress can designate Wilderness Areas on federal lands managed by the National Park Service, U.S. Forest Service, U.S. Fish and Wildlife Service, and the Bureau of Land Management. Neither Utah nor Colorado have a state wilderness program for lands under state jurisdiction; however, one state roadless area exists near the Uintah-Grand county line in Utah.

TABLE R-3-16

HUNTING AND FISHING DAYS AND SUCCESS RATIOS IN UINTAH COUNTY (1976-1980)[a]

	Hunter/Fisherman Days (1976-1980)	Success Ratio(%)
Mule Deer	122,356	32
Pronghorn Antelope	339	80
Elk	64,176	11
Upland Game[b]	145,838	NA
Waterfowl	9,715	NA
Warmwater Fish[c]	35,806	NA
Coldwater Fish[d]	49,774	NA

[a]The data for this table was derived from various reports developed by the Utah Division of Wildlife Resources for the 1976-1980 period (UDWR 1976-1981).

[b]Includes 11 species of upland game.

[c]Data based only on East Park Reservoir 1981 survey (UDWR 1982) and Steinaker Reservoir 1976 survey (UDWR 1982).

[d]Data based only on Pelican Lake 1977 survey (UDWR 1982).

Within the secondary influence zone, 27 wilderness units comprising 1,746,280 acres have been identified (Table R-3-17). Of these wilderness units, 3 have been recommended by the National Park Service for wilderness designation (NPS 1981; NPS 1974a; NPS 1971); 1 wilderness unit has been recommended for wilderness designation by the U.S. Forest Service in its second Roadless Area Review and Evaluation program (RARE II); 1 wilderness unit managed by the Forest Service is a part of the National Wilderness Preservation System; 21 wilderness units, administered by the BLM, have been either designated as Wilderness Study Areas (WSA), or are under formal appeal to the Interior Board of Land Appeals, and 1 area has been designated by the Ute Indian Tribe as the Wilderness Area of the Hill Creek Extension.

Two potential wilderness resource units are of particular concern because of their proximity to proposed project facilities. The Winter Ridge area is a BLM-administered area whose non-WSA status is under appeal (Pring 1981). Until the Interior Board of Land Appeals makes a final determination on this case (IBLA, Case #81-648), the Winter Ridge area will be managed as a wilderness area so as not to permanently impair its wilderness characteristic (BLM 1980a).

The Westwater Canyon area, south of Westwater, Utah, has been identified by BLM as a WSA and is currently under study to determine the unit's suitability for wilderness designation (BLM 1980a; BLM 1980d; Federal Register 1981). The study phase of the BLM's Utah wilderness review program is anticipated to be completed by mid-1984.

R-3.A.10 CULTURAL RESOURCES

Prehistory

The area of influence lies within the Uintah Basin of the Colorado Plateau (Stokes 1977). Previous studies indicate the presence of human activities in the area from 11,500 B.C. to the present. Within this time span, population patterns have fluctuated according to environmental and socioeconomic constraints. These population patterns have been assigned by prehistorians to several culture periods: Paleo-Indian Complexes, Archaic Cultures, Formative Cultures, and Numic Speaking Cultures (Forsyth 1980).

An overview study of the Uintah Basin reviewed all previous cultural resource studies and identified 990 recorded sites (Jones and MacKay 1980) categorized according to cultural affiliation and distribution with respect to certain environmental factors. The vegetation zones referred to in the cultural resource studies are roughly equivalent to the vegetation types discussed in Section R-3.A.4, Vegetation and Soils. The study concluded that the pinyon-juniper vegetation zone will have the highest site density, the sagebrush zone will have medium site density, and the shadscale, oakbrush, and mountain zones will have the lowest site densities. Archaic sites were relatively evenly distributed suggesting a broad subsistance pattern. Fremont sites were concentrated in pinyon-juniper vegetation areas (Jones and MacKay 1980). Additional work in the area has resulted in over 1,300 recorded prehistoric and historic sites (Phillips 1982).

TABLE R-3-17

DESIGNATED AND POTENTIAL WILDERNESS UNITS WITHIN THE SECONDARY ZONE OF INFLUENCE

Administering Agency	Unit Name and Number	Acres	State
National Park Service	Arches National Park	61,547	Utah
	Colorado National Monument	13,842	Colorado
	Dinosaur National Monument	205,672	Utah/Colorado
U.S. Forest Service	High Uintas Wilderness Area (proposed)	511,000a	Utah
	Flat Tops Wilderness Area	235,230	Colorado
Bureau of Land Management	West Cold Springs UT-080-103	235	Utah
	CO-010-208	14,352	Colorado
	Diamond Breaks UT-080-113	3,900	Utah
	CO-010-214	31,480	Colorado
	Bull Canyon UT-080-419	520	Utah
	CO-010-001	11,777	Colorado
	Winter Ridge UT-080-730	43,963	Utah
	Diamond Canyon UT-060-100B	48,240	Utah
	Cottonwood Canyon UT-060-100C	62,900	Utah
	Turtle Canyon UT-060-067	33,870	Utah
	Desolation Canyon UT-060-068A	217,130	Utah
	Wrigley Mesa/Jones Canyon/ Black Ridge Canyons UT-060-116-117 CO-070-113A	54,290	Utah/Colorado
	Westwater Canyon UT-060-118	30,800	Utah
	Daniels Canyon UT-080-414	2,475	Utah
	South Lost Spring Canyon UT-060-131B	3,880	Utah
	The Palisade CO-070-132	26,050	Colorado
	Little Bookcliffs Wildhorse Area CO-070-066	26,525	Colorado
	Demaree Canyon CO-070-009	21,050	Colorado
	Dinosaur Adjacent Units - North Boundary CO-010-229D CO-010-228 CO-010-226 CO-010-224A CO-010-224	22,640	Colorado
	Skull Creek CO-010-003	13,740	Colorado
	Oil Spring Mountain CO-010-046	17,740	Colorado
	Black Mountain CO-010-007A	5,077	Colorado
	Windy Gulch CO-010-007C	12,274	Colorado
	Cross Mountain CO-010-230	14,081	Colorado
Ute Indian Tribe	Wilderness Area of the Hill Creek Extension	160,000	Utah
	TOTAL	1,746,280	

Note: Table includes Wilderness Areas; Bureau of Land Management's Wilderness Study Areas and areas under appeal to the Interior Board of Land Appeals; and U.S. Forest Service RARE II units recommended for wilderness or further study within 100 miles or a 2-hour driving time from any of the seven applicants' proposed projects, or Vernal, Utah.

aU.S. Forest Service acreage proposed for Wilderness designation.

HIGH-LEVEL SCENARIO-CULTURAL RESOURCES

A 10 percent random sample of BLM lands immediately north of the White River and east of the Tosco project area was performed in 1980 (Larralde and Chandler 1981). During this study, 40 sites and 106 isolated finds were recorded. The sites were clustered in specific areas with the majority of sites located on a juniper-covered ridge. In areas characterized by juniper, site density was estimated to be 6.54 sites per square mile. In areas characterized by sand dunes without junipers, the site density was estimated to be 1.52 sites per square mile. Other areas were estimated to have 0.68 sites per square mile (Larralde and Chandler 1981).

A survey of oil shale lease areas south of the White River and west of the Utah-Colorado border was conducted by the Utah State Historical Society. This study located 31 archaeological sites. The sites included open campsites and rock shelter sites locatedwithinproximity to the White River. The artifacts from these sites documented the presence of archaic hunters and gatherers and the Uintah Basin variant of the Fremont culture. (Berry and Berry 1976)

Proposed oil and gas projects on public lands in Uintah County were surveyed by the Archaeological-Environmental Research Corporation (Hauck 1979). Nine sites were located and 13 previously recorded sites were relocated. The sites included temporary camps, a hunting campsite, and quarry sites located near tributaries of main washes. Most of the sites were adjacent to sandstone outcrops and had an eastern exposure. The overall site density was 1.5 sites per square mile. (Hauck 1979)

A survey of the Red Wash area in central Uintah County was performed by Nickens and Associates. Twenty-six archaeological sites were located. The prehistoric sites were sherd and lithic scatters, campsites, and quarry sites. The majority of the sites were associated with either the occurrence of juniper or sand dunes (Larralde and Nickens 1980). A survey of the Bookcliffs area in the southern portion of the study area was conducted by BLM. Approximately 80 sites were located and recorded (Negulesco 1981).

History

The area of influence is within the historic Ute territory. Contact with the Ute Indians was documented by the Spanish slave traders in the early 1800's. By 1825, fur trappers had ranged into the Uinta Mountains and traded with the Utes. Mormons settled in Utah in 1847 but were not successful in establishing a permanent early settlement in the Uintah Basin. Gilsonite, gypsum, and asphalt were discovered in the Uintah Basin in 1886 and this led to subsequent mining and white settlement of the area (Jones and MacKay 1980).

A summary of the historical research of the region is provided in the overview report by Jones and Mackay (1980). The historic sites in the region represent trails of the early pioneers and fur traders, early railroad and telegraph lines, military activities, mining activities, and stockman camps. In addition to the National Register of Historic Places, historic sites are listed on the Utah State Register of Historic Places and the Century Register of Utah Historic Homes. Over 1,300 prehistoric and historic sites have been recorded in the Uintah Basin (Phillips 1982). Properties presently listed on

the National Register of Historic Places that could be affected by the proposed projects are identified in the site-specific analyses.

R-3.A.11 VISUAL RESOURCES

Visual resources are a combination of the physical characteristics of a landscape and how the public which views the landscape perceives these characteristics and how they respond to changes which may be seen within the landscape. These physical characteristics are frequently described according to the perceivable form, line, color, and texture of the natural features found in the landscape which is being assessed. Visible change in the landscape is seen by the viewer when the land or water form or vegetation is modified from the natural condition and/or structures are added to that landscape. These concepts and the analysis process are discussed in detail in Appendix R-H, Visual Resource Management Methodologies.

The natural landscape within which the applicants' proposed projects and the interrelated projects would be overlain is characterized by a number of typical qualities that are common to the physiographic province in which the landscape is situated (Fenneman 1931). The physiographic province serves as a basis for determining what visible changes to the landscape would occur as a result of developing the proposed actions. For purposes of analyzing these changes, the BLM Visual Resource Management (VRM) system was used as an analytical tool (BLM 1978a). The methodology and definitions are outlined in Appendix R-H.

The visual resources within the area of influence were examined to understand what would happen to the resource with the advent of construction and operation of the proposed developments. Only the existing visual resources for those portions of the landscapes where significant visual impacts would occur are described in the EIS. (Refer to Section R-4.A.11, Visual Resources, for an explanation of the criteria used to determine the significance of impacts.)

The limited portion of the Colorado Plateau physiographic province which is of concern in this analysis consists of a mostly desert plateau with low rolling hills and occasional deep drainage patterns carved out by the White and Green rivers, and the Colorado River forming the boundary to the south and the Uinta Mountains bounding the area to the north. Five primary vegetation types cover the landform (see Section R-3.A.4, Vegetation and Soils).

VRM classes assigned to the region include VRM Class IV, which covers the majority of the region, and VRM Classes II and III, which occur along the more diverse river landscapes or other areas of contrasting landform, such as the Roan and Bookcliffs and Asphalt Ridge. Occasional VRM Class V areas are assigned where heavy oil and gas development presently occurs (BLM 1979a, 1981a, 1982b). Refer to Figure R-3-1 for generalized locations.

Cultural modifications within the region are sparse, but occur in the form of community developments such as Vernal, Fort Duchesne, Roosevelt, and Bonanza, Utah, and Rangely, Colorado. Additionally, resource development, in terms of

oil and gas and other mineral exploration, production, and development, is found throughout much of the area.

The region is visually sensitive as viewed primarily from communities, surface transportation routes (highways and rivers), and commercial aircraft.

R-3.A.12 PALEONTOLOGY

Based upon the geological processes that developed the Uintah Basin, there is a high probability that fossil-bearing strata would be encountered at any point within the basin. There are two formations that contain an abundance of fossils: the Green River Formation and the Uinta Formation. All the applicants' proposed projects would be in contact with one or both of these formations which contains fossils of important fish, reptiles, birds, and mammals would be encountered.

R-3.A.13 MINERAL AND ENERGY RESOURCES

The applicants' proposed projects would be located in a geologic basin rich in hydrocarbons. The principal hydrocarbons (oil shale and tar sand) are found in the Green River Formation. The total recoverable oil shale resources in the basin are estimated to be 825 billion tons (Smith 1981). In close association with this formation are various evaporite minerals, such as soda ash. Below these zones lie hydrocarbons, which include oil, gas, and coal.

R-3.A.14 EXISTING LAND USE PLANS

The applicants' proposed projects would lie within areas under the control of a number of separate jurisdictional entities that exercise certain types of land and resource use constraints (Table R-3-18). In addition, the Ute Tribe of the Uintah and Ouray Indian Reservation has indicated that a land use plan will be developed for the reservation in the near future. Presently, the Bureau of Indian Affairs with the concurrence of the Ute Tribal Council regulate development on the reservation through stipulations attached to right-of-way grants. The land status designations within the area of influence are shown on Map R-A-3 (located in Appendix R-A).

Nonconformance with BLM land use management framework plans (MFPs) would be resolved through amendments to those plans. Inasmuch as the NEPA process is a form of planning, land use conflicts would be adjusted by decisions made on the basis of this EIS. A decision by the federal government to implement the proposed projects or alternatives would be a decision to alter the existing land use planning decisions.

R-3.B **LOW-LEVEL SCENARIO**

The affected environment for all resources would be the same for the low-level scenario as identified for the high-level scenario. Refer to Section R-3.A, High-level Scenario, for discussion on specific resources.

TABLE R-3-18

EXISTING LAND USE PLANS

Planning Entity/Plan	Type of Plan	Projects Affected By Plan	Plan Aspect Involved
BLM (Vernal District Office)	Bonanza Management Framework Plan (Multiple Use)	Paraho, Syntana-Utah, Tosco	Restricts future east-west right-of-way to the designated right-of-way corridor and designates north and south corridors for same pupose and under the same constraints.
			Closes to surface occupancy all national resource lands adjacent to the Green and White rivers for 0.5 mile on line-of-sight.
			Allows no incompatible uses or improvements on or adjacent to the inventoried archaeological sites.
			Allows no surface disturbances on public lands contained within this area that will adversely affect the water quality of the Green or White rivers.
			Restricts all forms of human activities within identified antelope fawning areas from May 1 to June 15.
			Prohibits any surface disturbance activities within 1,000 feet of strutting ground.
	Rainbow Management Framework Plan (Multiple Use)	Geokinetics, Magic Circle Tosco	Restricts new transmission lines to existing corridors. Encourages consideration of underground lines as an alternative to aboveground lines along these corridors. Specific transmission line tie-ins should follow the most direct route to main transmission corridor.
			Allows no adverse impacts upon "natural, cultural, or recreation" values of the White and Green rivers as a potential candidates for National Wild and Scenic River designation.
			Allows no surface occupancy within line-of-sight within 1 mile of the White River.
			Allows no incompatible uses or improvements on or adjacent to archeaeological site AN-43-0808 Buck Canyon.
			Allows no incompatible uses or improvements on or adjacent to the Willow Overlook.
			Allows no surface disturbance or improvements on or adjacent to line-of-sight of the White River.
	Book Cliffs Management Framework Plan (Multiple use)	Enercor (Rainbow)	Restricts new transmission lines to existing corridors wherever possible. Transmission line tie-ins should follow shortest distance to main transmission corridor.
			Restricts operations involving heavy equipment such as trucking livestock, oil and gas exploration, drilling and other development activities to the period between April 3 and November 1 each year.
			Allows no excavation or other surface disturbance except grazing within the vicinity of any of the inventoried archaeological sites within this unit unless the cultural value are salvaged through a properly conducted archaeological salvage operation.
	Hill Creek Management Framework Plan (Multiple use)	Geokinetics	Restricts future right-of-way to existing rights-of-way.
			Requires culverts, waterbars, and drainage improvements on roads.
			Requires management of the Green River under the provisions and guidelines set forth for rivers protected under the Wild and Scenic Rivers Act.
			Allows no developments or surface disturbances that will adversely affect the scenic values along the travel influence zone.
Uintah County	Zoning Ordinance (Multiple Use)	All Projects	The county plans to approve a zoning ordinance in the near future; could have some constraints.

REGIONAL ENVIRONMENTAL CONSEQUENCES

This chapter discusses total combined impacts that may result from implementation of all the applicant's proposed synfuels projects (site-specific and conceptual) and the cumulative impacts that would result from implementation of the applicants' proposed projects and all anticipated developments in the area of influence whose impacts would interrelate with those of the applicants' projects (interrelated projects). Although the impacts from individual projects might be minor, when considered together, the impacts from all projects in an area could be significant. Descriptions of the applicants' projects and the interrelated projects included in this cumulative impact analysis are found in Section R-1.A, Introduction, the individual site-specific parts of this EIS, and Appendices R-B, R-C, and R-D. Specific impacts from the applicants' proposed site-specific projects also are analyzed in the site-specific part of this EIS.

A cumulative impact analysis is presented for two levels of development--a high-level production scenario that assumes full production of the applicants' projects and a low-level scenario that assumes a lower level of production for each project. The parameters of these scenarios are described in detail in Chapter R-1.

The impact analyses for each scenario were conducted for the points in time when the combined impacts of the applicants' proposed projects would be greatest. For some resources such as socioeconomics, two points were considered--the year when the applicants' combined construction work forces would peak and the year when their combined operation work forces would peak. For other resources such as vegetation, worst-case impacts were related only to peak construction activity, so it was only necessary to analyze impacts at one point--the peak construction work force year.

Throughout the EIS, the impact assessments are based upon assumptions that certain types of mitigation would be implemented and would alleviate or minimize environmental effects. These types of mitigation include:

1. Mitigation measures incorporated into the proposed projects' construction, operation, and maintenance procedures (standard operation procedures). These measures are committed to by the applicants and are described in the various site-specific Chapter 1's.

2. Mitigation measures enforceable on lands administered by the agencies with authorizing actions (BLM, Forest Service, Bureau of Indian Affairs in conjunction with the Ute Tribal Council, state agencies, and others). These measures only can be committed to by the agencies for use on lands or in areas where the respective agencies have jurisdiction. The measures are described in Appendix SS-A, General Measures.

SIGNIFANCE CRITERIA

Following the assessment of impacts, additional mitigation measures were identified that could further alleviate or minimize environmental effects. However, these measures are not committed to as yet by any authorizing agencies or by the applicants. Therefore, implementation of these measures was not assumed in the impact analysis. These additional, uncommitted measures, which could be incorporated at a decision maker's and/or an applicant's discretion, are described in Appendix R-I.

IMPACT SIGNIFICANCE CRITERIA

The impacts discussed in this EIS are characterized as either significant or insignificant. The criteria on which these judgments are based are identified below. These criteria are regulatory standards, commonly used professional research standards, or where no generally recognized standards exist or apply, a subjective standard based on field experience and applicable professional research. Unless stated otherwise, the criteria were used for the regional cumulative analysis and the site-specific analyses found in the second part of this EIS.

SOCIOECONOMICS

Increases in population and employment of 10 percent or greater were considered to be significant. Other socioeconomic factors were considered to be significantly affected if the additional needs exceeded 10 percent of baseline capacity. This criteria is based on a Denver Research Institute study (Gilmore and Duff 1975), which identified 10 percent as a general threshold level at which a government's ability to provide service breaks down. (See Section R-3.A.1 for greater explanation.)

There are no standards or criteria established for determining how much population and employment growth would be significant for the Uintah and Ouray Indian Reservation.

AIR QUALITY

Relevant criteria for assessing the significance of predicted air quality impacts are, in part, the established state and federal air quality program requirements for maintenance of ambient air quality standards, prevention of significant air quality deterioration, and protection of air quality related values.

The national primary and secondary ambient air quality standards (NAAQS) (Table R-4-1) were developed to identify air pollutants of concern (criteria pollutants) and establish maximum ground-level concentration limits which were allowable, with an adequate margin of safety, to protect human health (primary standards) and public welfare (secondary standards). Public welfare includes effects on soils, water, crops, vegetation, man-made materials, animals,

TABLE R-4-1

APPLICABLE STATE AND FEDERAL AMBIENT AIR QUALITY STANDARDS
(ug/m^3)

Pollutant	Federal	Utah	Colorado
Sulfur Dioxide (SO_2)			
(annual)	80	80	80
(24-hour)	365	365	365
(3-hour secondary)	1,300	1,300	1,300
Total Suspended Particulates (TSP)			
(annual primary)	75	75	75
(24-hour primary)	260	260	260
(annual secondary)	60	60	60
(24-hour secondary)	150	150	150
Carbon Monoxide (CO)			
(8-hour)	10,000	10,000	10,000
(1-hour)	40,000	40,000	40,000
Ozone (O_3)			
(1-hour)	240	240	240
Nitrogen Dioxide (NO_2)			
(annual)	100	100	100
Hydrocarbons			
(3-hour)	160		
Fluorides (as HF)			
(24-hour)			
Lead			
(1/4 year)	1.5		
Hydrogen Sulfide (H_2S)			
(30-minute average)			

wildlife, weather, visibility, climate, damage to and deterioration of property, and hazards to transportation as well as effects on economic values and on personal comfort and well-being.

The prevention of significant deterioration (PSD) regulations (Table R-4-2) have been established to protect air quality in those areas which are presently better than the ambient air quality standards and are more stringent than the NAAQS. Class I areas are protected by incremental increase limitations for sulfur dioxide (SO_2) and total suspended particulates (TSP). Under the PSD regulations, all areas determined to have air quality better than the NAAQS (attainment areas) are classified as Class I, II, or III.

Several requirements of PSD review apply only to pollutants emitted in significant amounts; these significant levels are presented in Table R-4-3. These values provide criteria for determining whether specific pollutant emissions for a source are significant, thus requiring ambient air quality modeling.

In addition to the federal PSD requirements, the State of Colorado has adopted standards for sulfur dioxide expressed as allowable amounts of increase in ambient concentrations over an established baseline. Like PSD, these standards have been adopted for three categories (I, II, and III) of land areas or regions. The increment limits for these state categories are the same as the PSD Class I, II, and III increments for sulfur dioxide.

Currently there are no clear objective criteria for judging adverse visibility impairment in Class I areas. However, the EPA visibility regulations, promulgated on December 2, 1980, (Federal Register, pp. 80084-80095) state that adverse visibility impairment will be determined on a "...case-by-case basis taking into account the geographic extent, intensity, duration, frequency and time of visibility impairments, and how these factors correlate with (1) times of visitor use of the federal Class I area, and (2) the frequency and timing of natural conditions.

More objective criteria for determining adverse visibility impairment are outlined in the EPA document entitled "Workbook for Estimating Visibility Impairment" (Latimer and Ireson 1980). That document suggests the following criteria: if a plume contrast or sky/terrain contrast change greater than plus or minus 0.10, or a plume discoloration corresponding to a delta E (*L*a*b) of 4, or a blue-red ratio of 0.9 is predicted to occur on the worst day, the probability of adverse visibility impairment cannot be ruled out.

The existing mandatory Class I areas in the area of influence that are currently afforded visibility protection are administered by the U.S. Forest Service (USFS). The USFS has not yet established specific criteria for judging the significance of visibility impairment, except to state that visibility effects, such as changes in contrast, coloration, and visual range, should be considered. The USFS has not identified any "integral vistas," which are views from within a Class I area of landscape features located outside an area, that are afforded visibility protection.

REGIONAL Tables for Chapter 4/UBSREG.T4
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TABLE R-4-2

PREVENTION OF SIGNIFICANT DETERIORATION INCREMENTS

Pollutant	Averaging Time	Maximum Allowable Concentrations (ug/m^3) Class I	Class II	Class III
Sulfur Dioxide (SO_2)	Annual	2	20	40
	24-hour	5	91	182
	3-hour	25	512	700
Total Suspended Particulates (TSP)	Annual	5	19	37
	24-hour	10	37	75

TABLE R-4-3

EPA SIGNIFICANT EMISSION RATES

Pollutant	Emissions Rate (tons/year)
Carbon monoxide	100
Nitrogen oxides	40
Sulfur dioxide	40
Total suspended particulates	25
Ozone (volatile organic compounds)	40
Lead	0.6
Asbestos	0.007
Beryllium	0.0004
Mercury	0.1
Vinyl chloride	1.0
Fluorides	3
Sulfuric acid mist	7
Total reduced sulfur (including H_2S)	10
Reduced sulfur (including H_2S)	10
Hydrogen sulfide	10

SIGNIFANCE CRITERIA

The National Park Service (responsible for Dinosaur and Colorado National Monuments) and the USFS (responsible for Flat Tops and Mount Zirkel Wilderness Areas) are in the process of identifying air quality related values and criteria for determining adversity of effects of these values. When this process is complete, these criteria will be used in the PSD process.

Although the air quality analysis in this EIS is not for the purposes of obtaining a PSD permit and would not satisfy that process, comparison of predicted ground-level pollution concentration to both the NAAQS and PSD provide guidelines for the determination of the significance or insignificance of an air quality impact.

WATER RESOURCES

Impacts to streams were considered to be significant if flow were decreased by more than 10 percent in any individual river or by more than 1 percent at the inflow to Lake Powell. These percents are based on experiences of critical flow decreases in the areas in question. Significant impacts also were considered to result if salinity would be increased.

Impacts to floodplains were considered to be significant if aboveground, permanent facilities including spent shale disposal piles would be located on a 100-year floodplain.

Impacts to ground water would be considered significant if ground water were withdrawn at a rate that exceeds recharge, thereby mining ground water. Significant impacts would also result if large continuous aquifers were dewatered by mining techniques.

VEGETATION AND SOILS

Impacts to vegetation due to removal of cover and surface disturbance were considered to be significant if it would take more than 10 years following construction to reestablish a ground cover of vegetation. The 10-year period is based upon maximum time expected for growth and reproduction of plants. Impacts were also considered to be significant if implementation of the proposed action and alternatives would allow poisonous or introduced plants (for example, halogeton) to invade more than 20 percent of a specific vegetation type along a right-of-way.

Impacts to soils from expected construction-related increases in erosion rates and reduction of soil productivity were considered to be significant if the loss of soil and reduction of soil productivity would prevent successful restoration and recovery to near preconstruction conditions.

WILDLIFE

Adverse impacts to wildlife due to vegetation and surface disturbances were considered to be significant if more than 5 percent of the total available crucial habitat (e.g., winter range, calving/fawning areas, leks, brooding areas) would be disturbed. Indirect impacts caused by human population increases were considered to be significant if the estimated increases in poaching, wanton killing, and harassment would exceed 15 percent over present levels. The above percent figures are based on knowledge of critical habitat and wildlife poaching, killing, and harrassment in the areas in question.

Threatened or endangered species are being considered on a case-by-case basis as part of the U.S. Fish and Wildlife Service Section 7 consultation process. In the EIS, any impacts to these listed species were considered significant if any species in these categories would be adversely affected by implementation of a project.

AGRICULTURE

Impacts to cropland were considered to be significant if more than 5 acres of cropland within a project area would be irreversibly converted to other uses (as a result of placement of permanent facilities) or if the viability of any croplands were significantly diminished by a project activity, or if cropland outside a project area is affected to the extent that more than 5 percent of the total cropland of the region would be irreversibly converted to other use due to project development.

The effect of vegetation removal as a result of construction of the project components would be significant if reduction in carrying capacity would result in a region-wide reduction in livestock numbers of 5 percent or more. Any cattle or sheep operation that would sustain a reduction in livestock numbers could experience a hardship depending upon the economic health of the ranch unit. A reduction in livestock numbers of 5 percent or greater would be considered a significant impact.

TRANSPORTATION NETWORKS

Impacts to roads were considered to be significant if the projected average annual traffic increases would reduce the level of service to Level D or below, as defined in the Highway Capacity Manual (American Association of State Highway and Transportation Officials 1965).

Any increase in projected average annual traffic on dirt or semipaved roads within the Uintah and Ouray Indian Reservation were considered to be significant if it would result in a reduction in level of service or deterioration of the roads.

SIGNIFANCE CRITERIA

RECREATION

The determination of positive or negative impacts upon the recreation resource is related to user's expectation, availability of recreation opportunities, and the recreation setting. These three factors form the basis which determines whether experiences are of high quality and positive or of low quality and negative.

Impacts to recreation resources were considered to be significant if either or both the following criteria were met:

> If the public's short-term sensitivity and perceived concerns about construction activity would be high (thereby diminishing the quality of recreation experiences). Short-term is defined to be one recreation season beyond completion of construction.
>
> If the public's long-term sensitivity and perceived concerns about operation activity would be medium to high (where the quality of the recreation experience would fail expectations). Long-term is defined to be 1 year through the life of a project.

Short-term or long-term recreation impacts that would not generate public concern (such as impacts to an area not regularly used or an area with ample recreation facilities) would be insignificant.

WILDERNESS

Impacts would be significant if any components of the proposed actions or alternatives crossed the boundary of a Wilderness Area; a BLM Wilderness Study Area (WSA) or an area under appeal and therefore managed under the Interim Management Policy and Guidelines for Lands Under Wilderness Review (BLM 1980b); a U.S. Forest Service second Roadless Area Review and Evaluation unit (RARE II) area recommended either for wilderness designation or a further study area; or a proposed or existing state roadless area or tribal wilderness area.

Indirect impacts that would permanently impair the wilderness characteristics of a wilderness unit also were considered to be significant. An example of a significant indirect impact would be air quality degradation that would permanently impair visibility or the growth of flora and fauna within the boundaries of a wilderness unit. A major increase in visitation to a wilderness unit which would jeopardize solitude and naturalness characteristics also was considered to be a significant indirect impact.

CULTURAL RESOURCES

Impacts to cultural resources were considered to be significant if any information would be lost that would impede efforts to reconstruct the prehistory or history of the region. Impacts to any cultural resource on or eligible for inclusion on the National Register of Historic Places also were considered to be significant.

VISUAL RESOURCES

Impacts to the visual resource were considered to be significant if modification in the landform and vegetation or the addition of a structure would not meet the standards of the VRM Class or VQO in which the portion of the project would be located. Significance was determined by the Contrast Rating System, which analyzes the contrast in form, line, color, and texture of the landscape and the time lapsed before the impacts are reduced to an acceptable condition (discussed in further detail in Appendix R-H).

PALEONTOLOGY

Impacts to paleontology were considered to be significant if fossils of limited occurrence were altered, damaged, or destroyed.

R-4.A HIGH-LEVEL SCENARIO

The high-level production scenario assumes that all the applicant's projects (site-specific and conceptual) would be developed to full production levels. The parameters of this scenario are described in detail in Section R-1.B, High-level Scenario. Baseline conditions for the environment that would be affected by this level of regional development are discussed in Chapter R-3.

R-4.A.1 SOCIOECONOMICS

As mentioned in Section R-3.A.1, Socioeconomics, only the counties, communities, and Colorado area that are expected to experience significant socioeconomic impacts are included in this analysis in addition to the Uintah and Ouray Indian Reservation. The analysis presented here is summarized from the Socioeconomics Technical Report (State of Utah 1982b). The direct employment data that was incorporated into the Utah Process Economic and Demographic (UPED) computer model to obtain the total employment and population projections used in this analysis are included in the technical report. Direct employment assumptions for the interrelated projects are shown in Appendix R-F.

Population and Employment

Under this scenario the applicants' construction work force would peak in 1985; the operation work force would peak in 1995.

The applicants' proposed projects would cause a population increase of 28,916 in 1985, and 50,128 in 1995, in the eight affected counties (Uintah, Duchesne, Daggett and Grand counties, Utah; Rio Blanco, Moffat, Garfield, and Mesa counties, Colorado). The cumulative (including interrelated projects) population increase would be 33,930 in 1985, and 72,857 in 1995.

Within the identified socioeconomic area of influence (Uintah and Duchesne counties and the Colorado area), population increases would also be very large. Table R-4-4 indicates that during 1985, the area would increase by 26,973 persons due to the applicant's proposed projects. When adding interrelated projects, the increase would total 29,804. Compared to the 1985 population baseline for the area, this results in a 34.7 percent and 38.3 percent increase, respectively. In 1995, increases over baseline would total 47,906 for the applicants' proposed projects, and 65,222 with the addition of interrelated projects. These are increases over baseline of 55.3 percent and 75.3 percent, respectively.

Uintah County would receive the greatest population growth within the area of influence. In 1985, the population of Uintah County would increase by 67.3 percent over baseline as a result of the applicants' projects. This would increase to 73.6 percent when including interrelated projects. In 1995, Uintah County would experience an even more dramatic increase. The applicants' growth alone would be 108.3 percent over baseline; with interrelated projects, growth would increase to 147.9 percent over the 1995 baseline.

On a community level, Vernal would experience the greatest population growth during 1985 and 1995; however, the community of Dinosaur would have the greatest population growth relative to baseline, with increases ranging from 90.4 to 103.2 percent in 1985 and 188.5 to 410.3 percent in 1995.

Unincorporated areas within certain counties are also expected to receive substantial impacts. For instance, the unincorporated portion of the Ashley Valley likely would have substantial increases in population. Based on impacts from the applicants' projects, the increase over baseline would be 51.9 percent in 1985; with interrelated projects, the increase over baseline would be 59.5 percent. In 1995, the increases would be 135.4 percent and 190.3 percent, respectively (refer to the Socioeconomics Technical Report (State of Utah 1982b)).

Table R-4-5 presents employment by work place. This information is presented for each county in Utah and the Colorado area (Moffatt and Rio Blanco counties). Employment statistics are not available for community level analysis. For the area of influence, total employment in 1985 is expected to increase by 45.9 percent over the baseline as a result of the applicants' proposals and 50.5 percent including interrelated projects. In 1995, these increases are projected to be 54.6 percent and 74.5 percent, respectively.

TABLE R-4-4

POPULATION BY COUNTY AND COMMUNITY
High-level Scenario

Area	Baseline	1985 Applicant Increase People	%[a]	1985 Interrelated Project Increase	1985 Cumulative Increase People	%[a]	Baseline	1995 Applicant Increase People	%[a]	1995 Interrelated Projects Increase	1995 Cumulative Increase People	%[a]
Duchesne County	17,778	+ 4,602	25.9	+ 363	+ 4,965	27.9	18,684	+ 9,779	52.3	+ 2,554	+12,333	66.0
Roosevelt	5,416	+ 3,184	58.8	+ 244	+ 3,428	63.2	5,934	+ 6,775	114.2	+ 1,758	+ 8,533	143.8
Myton	705	+ 159	22.5	+ 12	+ 171	24.2	773	+ 339	43.7	+ 88	+ 8,427	55.1
Remainder of County	11,657	+ 1,259	10.8	+ 107	+ 1,366	11.7	11,977	+ 2,665		+ 708	+ 3,373	
Unitah County	25,730	+17,309	67.3	+1,631	+18,940	73.6	29,863	+32,343	108.3	+11,831	44,174	147.9
Vernal	9,291	+ 5,600	60.3	+ 565	+ 6,165	66.3	11,369	+14,124	128.1	+ 4,662	18,786	165.1
Ballard	775	+ 203	26.1	+ 20	+ 223	28.7	976	+ 376	38.5	+ 88	464	47.5
Remainder of County	15,664	+11,506	73.4	+1,046	+12,552	80.1	17,518	+17,843	101.8	+ 7,081	24,924	141.1
Grand County	9,850	+ 4,032	40.9	+ 691	+ 4,723	47.9	10,324	+ 3,963	38.4	+ 4,915	+ 4,878	47.2
Colorado Area												
Rangely	3,193	+ 577	18.1	+ 82	+ 659	20.6	3,805	+ 1,020	26.8	+ 1,073	+ 2,093	55.0
Dinosaur	501	+ 453	90.4	+ 64	+ 517	103.2	425	+ 801	188.5	+ 943	+4,8784	410.3
Remainder of Moffat & Rio Blanco counties	24,355	+ 1,030		+ 146	+ 1,176		27,646	+ 1,821		+ 2,016	+ 3,837	
Area of Influence	77,713	+26,973	34.7	2,831	+29,804	38.3	86,517	47,906	55.3	+21,316	+65,222	75.3

Source: Utah Process and Demographic Model. Utah State Planning Coordinate's Office, March and May 1982.

[a]Addition divided by baseline for that year.

[b]Only those interrelated projects that would effect the determined socioeconomic area of influence are included here. These projects are identified in Appendix R-F.

TABLE R-4-5

EMPLOYMENT BY COUNTY
High-level Scenario

	Duchesne	Uintah	Grand	Colorado Area[a]	Area of Influence
1985					
Baseline	7,203	10,585	4,164	13,933	35,885
Applicants' Increase	719	12,910	2,717	136	16,482
Other Projects Increase	71	1,105	437	20	1,633
Cumulative Impacts	790	14,015	3,154	156	18,115
Applicants % Impact[b]	+10.0	+122.0	+ 65.2	1.0	45.9
Cumulative % Impact[c]	+11.0	+132.0	+ 75.7	1.1	50.5
1995					
Baseline	7,070	11,886	4,368	15,273	28,597
Applicants' Increase	1,929	16,775	2,076	307	21,087
Other Projects Increase	600	5,998	457	603	7,658
Cumulative Impacts	2,529	22,773	2,533	910	28,745
Applicants % Impact[b]	+27.3	+141.1	+ 47.5	2.0	54.6
Cumulative % Impact[c]	+35.8	+191.6	+ 58.0	6.0	74.5

Source: Based on data from the UPED model, Utah State Coordinator's Office, March 1982.

[a]Includes Moffatt and Rio Blanco counties.

[b]Percent increase over baseline due only to the applicants' projects.

[c]Percent increase over baseline due to the applicants' projects with other interrelated projects.

Uintah County would have the greatest increase in employment for both 1985 and 1995. In 1995, Uintah County employment would more than double over the baseline due to the applicants' projects. During 1995, the Colorado area (Moffatt and Rio Blanco counties) would experience increases of 2.0 percent and 6.0 percent, respectively. Uintah County, as expected, would have the greatest increase in employment for 1985 and 1995. In 1995, Uintah County employment would more than double over the baseline due to the applicants' development. During 1995, the Colorado area (Moffatt and Rio Blanco counties) would experience more impacts from interrelated projects than from the combined effects of the applicants' proposals.

The Uintah and Ouray Indian Reservation would experience in-migration and out-migration as a result of the synfuels projects. In-migration would occur due to population moving into the communities of Roosevelt, Myton, Ballard, Duchesne, and Fort Duchesne; squatters settling on Indian lands; and tribal members returning to the reservation for employment opportunities. A minor amount of out-migration would occur due to tibal members moving off the reservation and closer to jobs. However, the out-migration would not be significant. In-migration could cause a change in the age structure of the reservation by raising the percentage of persons under the age of 34. Since this percentage is already relatively high (73 percent of total population is under 34 years) an increase would create significant impacts.

The high-level scenario would have a positive effect upon the tribe's 52 percent unemployment figures, as more jobs would be available associated with synfuels development. An additional secondary positive impact would also occur due to more job opportunities associated with supporting services and businesses in surrounding communities.

There would also be potential for negative impacts associated with the increase in employment opportunities. Those tribal members with specific skills who are now working for the BIA, tribal government, or other tribal enterprises could be attracted to synfuels jobs because of higher wages. This could cause shortages of services within the reservation which require specific job skills.

Even though synfuels development would provide sufficient jobs for unemployed tribal members, there may be a problem in matching skills to available jobs. Should training programs be established this would alleviate this problem. However, in the short-term, tribal members may not be able to obtain jobs due to lack of qualifications.

Personal Income

The high-level scenario would be expected to increase the per capita personal income (PCPI) level of the area of influence over what is projected for the baseline. In 1985 (peak construction year), the disparity would be significant. The effect of the applicants' proposed projects would raise the PCPI level to $11,526 in the area by 1985, as compared to the baseline projection of $9,373 (both 1980 dollars). This is a 23.0 percent increase.

The PCPI level with interrelated projects would be $11,636. For 1995, PCPI within the area of influence would be slightly smaller with a level of $11,364 (1980 dollars) as a result of the applicants' proposals. This compares to a baseline projection of $10,436. With interrelated projects, PCPI would increase to $11,551.

The majority of personal income increases would occur in Uintah County. In 1985, 75 percent of total personal income increases would occur in Uintah County as a result of the applicants' proposed projects. The cumulative impact increase would be approximately the same as the applicants' proposals.

The Colorado area would experience very little of the personal income increases. In 1985, 4.5 percent of the total personal income increases generated by the applicants' proposals would be in the Colorado area. The cumulative impact increase would be 4.7 percent.

The substantial increases in personal income for the area of influence of $406.7 million (1980 dollars) in 1985, and $573.0 million in 1995, would have significant effects on the cost of consumer goods and services and on the cost of housing. Significant local price inflation would result from local increased purchasing power. This would have a serious adverse effect to those with fixed incomes like the elderly and those who do not possess the skills to be employable in the higher income occupations. Minority groups in the impact area, such as the members of the Ute Indian Tribe who have an income much less than the other local residents, potentially would be vulnerable to escalating prices unless an active minority hiring policy is followed.

There is a very low per capita personal income among the Indians who live on the reservation (due to large households and low income). The increase in employment would raise income and possibly the number of employed per household, which would have a positive impact on the per capita personal income level of the tribe. Any increase in either personal income or numbers of employed would benefit the tribe's income levels.

Housing

Adequate housing provides a basic foundation for community stability and well being. Previous analysis of worker preference defines housing adequacy as a critical factor in determining job satisfaction (Mountain West Research 1982). In fact, inadequate housing facilities in other rapid growth situations has been cited a major contributor to very expensive, high work force turnover rates. The impacts of the high-level scenario could seriously test the ability of the affected communities to provide adequate and affordable housing. Those areas defined as significantly affected, that is having a 10 percent growth over baseline, have a low housing vacancy rate (0 to 3 percent). Limited housing supply coupled with land speculation has already contributed to an increase in housing costs in Vernal and the surrounding area. Table R-4-6 shows the additional household demand that would result from the applicants' proposed projects, the interrelated projects, and the cumulative effects from both. As indicated, housing demand

TABLE R-4-6

HOUSING DEMAND
High-level Scenario

Area	1985 Baseline Households	1985 Applicant Increase Households	1985 Applicant Increase %	1985 Interrelated Project Households	1985 Cumulative Increase Households	1985 Cumulative Increase %	1995 Baseline Households	1995 Applicant Increase Households	1995 Applicant Increase %	1995 Interrelated Projects Households	1995 Cumulative Increase Households	1995 Cumulative Increase %
Duchesne County	5,323	1,560	29.3	123	1,683	31.6	5,369	2,876	53.6	738	3,614	67.3
Roosevelt	1,622	1,098	67.7	83	1,181	72.8	1,709	1,993	116.6	542	2,535	148.3
Myton	201	54	26.9	4	58	28.9	201	100	49.7	25	125	62.2
Remainder of County	3,500	408	11.7	36	444	12.7	3,459	783	22.6	171	954	27.6
Uintah County	7,706	4,356	56.5	493	4,859	62.9	8,581	9,452	110.1	3,419	12,871	150.0
Vernal	3,087	1,898	61.5	192	2,090	67.7	3,620	4,154	114.7	1,347	5,501	152.0
Ballard	205	69	33.7	7	76	39.1	248	111	44.8	25	136	54.8
Remainder of County	4,414	2,389	54.1	294	2,693	61.0	4,713	5,187	110.0	2,047	7,234	153.5
Colorado Area												
Rangely	1,116	196	17.5	28	224	20.1	1,330	300	22.6	310	610	45.9
Dinosaur	176	154	87.5	29	176	100.0	149	236	158.4	273	509	186.4
Remainder of Moffat & Rio Blanco Counties	8,536	649	7.6	50	698	8.1	9,688	536	5.5	583	1,119	11.5
Area of Influence	21,565	6,565	30.4	666	7,240	33.6	23,638	12,864	54.4	4,740	17,604	74.5

Source: Utah Process and Demographic Model (UPED), State Planning Coordinator's Office, June 15, 1982.

NOTE: Households is defined to be an individual, or related or unrelated individuals living together in a housing unit.

would increase substantially over the baseline projections. For the socioeconomic area of influence, the percentage increases would be 30.4 in 1985, and 54.4 in 1995. With interrelated projects, increased housing demand over baseline would be 33.6 percent in 1985, and 74.5 percent in 1995. Uintah County would experience the majority of the housing demand increases. Vernal would experience the greatest absolute housing demand increases for the communities included in the area of influence. Dinosaur, however, would experience the greatest housing demand increase compared to its baseline.

There is currently a housing shortage on the Uintah and Ouray Indian Reservation. Any new growth on the reservation would seriously exacerbate this shortage.

There also may be some situations where tribal members would move from one area of the reservation to another to be closer to jobs. This may create shortages and crowding in existing housing.

Government Services and Facilities

The impacts on government services and facilities are summarized below for the high-level scenario. These assessments were based on data received from the Utah Department of Community and Economic Development. For a more detailed discussion of impacts, assumptions, and project methodologies, refer to the Socioconomics Technical Report (State of Utah 1982b).

Education

Significant increases in teachers and classrooms over projected baseline would be required in the area of influence, under the high-level scenario. Uintah County would be the most severely affected, having a demand for an additional 102 teachers and classrooms in 1985 and 333 by 1995 as a result of the applicants' proposed projects. This represents a 37.5 percent and 88.8 percent increase over baseline, respectively. With interrelated projects, the increase would be 41.7 percent in 1985, and 122.6 percent in 1995. Duchesne County would also be severely affected, with a 19.4 percent increase over baseline in demand for teachers and classrooms in 1985 as a result of the applicants' proposed projects. In 1995, this would rise to 43.5 percent over baseline. Interrelated projects would contribute very little to this demand. Such large increases in classrooms would require the expansion of the school systems to at least equal this demand, since the baseline demand would eliminate any existing capacity.

For Rangely and Dinosaur, demand due to the applicants' proposals or interrelated projects is not expected to rise significantly for 1985 or 1995. More than enough classroom capacity would be available; however, additional teachers would be in demand. Considering the applicants' proposed projects, teacher demand over baseline would increase by 3.8 percent in 1985 and 7.3 percent in 1995. When considering interrelated projects, the additional demand in 1985 would remain relatively low, with a 15.1 percent increase.

The addition of new population to the area would increase enrollment within the schools presently attended by Indians. This increase would create a larger pupil-to-teacher ratio, which would have a significant impact upon Indian children due to their being substantially behind their non-Indian counterparts.

In addition, the increased enrollment in public schools could shift priorities from special programs designed for Indian children to the public schools. This would affect education of tribal members, because these special programs serve to assist Indian children in keeping up with non-Indian children.

Medical

All medical services and facilities would be severely affected under the high-level scenario, because the additional capacity needed to support the increases due to the applicants' proposals and interrelated projects would not be available. Even under the baseline demand, there would be a need for additional physicians, nurses, and hospital beds by 1985 (refer to Section R-3.A.1, Socioeconomics). Uintah County would experience the most significant impacts. Duchesne County would also have a substantial increase in needs. Under the high-level scenario, the area of influence would have a demand for an additional 10 physicians in 1985 and 24 in 1995 as a result of the applicants' proposed projects. An additional 31 nurses would be in demand (approximately a 27 percent increase) in 1985 and 73 (approximately a 57 percent increase) in 1995. Additional hospital beds would also be in demand, with a 26.5 percent increase in the socioeconomic area of influence in 1985 and a 57.9 percent increase in 1995 as a result of the applicants' proposals. Duchesne County would have approximately a 30 percent increase in demand in 1985 and a 50 percent increase in 1995. The addition of interrelated projects would not substantially add to these percentage increases.

The new medical clinic at Fort Duchesne is expected to be finished in 1982 and is intended to handle the majority of the tribe's medical services.

Mental Health

The mental health services are presently inadequate in the socioeconomic area of influence; therefore, increased population as a result of the applicants' proposed projects and interrelated projects would further contribute to the mental health services problems.

There is currently a critical need for mental health services and an alcohol detoxification facility on the Uintah and Ouray Indian Reservation. Any increase in Indian population, combined with unemployment (caused by mismatched skills) and cultural stress caused by boom-type growth would add to the mental health needs and create a significant impact.

Law Enforcement

Jail facilities would have to be expanded in the area of influence in response to the increased population growth under the high-level scenario. Also, significant increases over baseline in demand for law officers and patrol cars would occur. In 1985, Uintah County would have an increase in demand over baseline of 45.2 percent for law officers as a result of the applicants' proposed projects. By 1995, the demand would be 100.0 percent over baseline. The demand for patrol cars would increase by 50.0 percent in 1985, and 44 percent in 1995 due to the applicants' proposals. With interrelated projects, the demand increase in 1985 would differ very little from the applicants' proposals. In 1995, however, Uintah County police officer demand would be 140.0 percent over baseline, while patrol car demand would be 77.8 percent. Duchesne County and the Colorado area would have substantially lower impacts in demand for police officers and patrol cars, even when considering interrelated projects. In 1995, Duchesne County would have a cumulative increase in demand of 25.0 percent, while the Rangely/Dinosaur area would have a demand increase of 14.5 percent. In 1995, the increased cumulative demand for police cars would be 16.7 percent for Duchesne County, and 7.1 percent for the Rangely/Dinosaur area.

The tribal government has been experiencing an increase in law enforcement problems such as trespassing and poaching occurring from oil workers crossing the reservation. The increase in arrests and patrolling have added extra workloads for law enforcement officials and tribal courts. Any increase in population and activity in the area would create the need for more law enforcement services (jails, personnel) on the reservation.

Fire Protection

Fire equipment increases would be required in the area of influence, but impacts would not be as acute as for some of the other services mentioned. Additional fire pumpers would be required. Uintah County would have the largest increase in demand in terms of number of fire pumpers, although Duchesne County would have the greatest percentage increase. In 1985, Uintah County would have a demand for two additional pumpers, while Duchesne County would have a demand for one.

Increased population and activity associated with high-level development would increase the incidence of building and range fires on the reservation. This would create a need for more fire protection services within the reservation.

Sewer

Vernal would be the most severely affected community. In 1985, demand is projected to increase over baseline by 60.3 percent due to the applicants' proposed projects. By 1995, the increase in demand would be 114.2 percent. With interrelated projects, the additional demand over baseline would be 65.2 percent. Vernal would be able to handle the increased demand from the

applicants' proposals and interrelated projects if the planned sewer system is built. This sewer system would have a capacity of 40,000 persons and provide service to Vernal's identified service area.

Roosevelt's present 12,000 person capacity system would be affected in 1995 by a predicted 114.2 percent increase as a result of the applicants' proposed projects. With the added demands of the applicants' projects, the present capacity would be marginally exceeded. With interrelated projects, capacity would be exceeded by an estimated 20.5 percent.

Upgrading of the current reservation sewer system has already been proposed. With the high-level associated growth, further expansion of the sewer system could be necessary, which would require a significant increase in tribal capital expenditures.

Water

The high-level scenario would produce additional demands for water in all the communities identified in the socioeconomic area of influence. Vernal would be the most significantly affected in terms of demand (water connections), with increases of 60.3 percent over baseline in 1985, and 124.2 percent in 1995 due to the applicants' proposals. With interrelated projects, increased water demand would be 66.3 percent and 165.2 percent, respectively. If Vernal constructs its planned expansion of the existing water system, the additional demand would be accommodated. Roosevelt's demand in 1985 would be 58.7 percent as a result of the applicants' proposed projects. With interrelated projects, demand would be 63.3 percent in 1985, and 143.8 percent in 1995. Roosevelt's present system capacity of 10,600 persons would have to be expanded by as much as 36.5 percent. Myton, Ballard, and the communities of Dinosaur and Rangely, would also have to add substantially to their present water capacity.

Upgrading and expanding the reservation's water system has already been proposed. Any further needs associated with the high level of development would create need for further tribal funds, which could be significant.

Fiscal

Although all counties and communities in Utah presently appear fiscally sound, it is expected that severe fiscal pressures would result from the high-level scenario unless mitigated by federal, state, and/or private funds. The rapid growth in population would cause immediate service demand increases, which would have to be met. Revenues would lag, creating a severe short-term deficit situation.

Also, there could be additional long-term adverse effects with new facilities being under-utilized after the population begins to decline from peak levels.

Tribal Jurisdiction and Finances

The construction and operation of the applicants' proposed projects and interrelated projects would create a potential for jurisdictional conflicts. In general, population increases and in-migration of non-Indians on the reservation would negatively affect tribal management activities and could complicate the distinction between municipal, county, state, federal, and tribal governments and jurisdictions.

Growth associated with the high-level development would have a significant impact on the tribe's ability to keep up with costs of improving reservation infrastructure. Many of the synfuels-related financial impacts to the tribe's infrastructure could be alleviated by provision of front-end monies. Due to recent changes in the political and economic climate, the emphasis of financial support has shifted from the federal government to the tribal government, thus trying to make the tribe more self-sufficient. Programs currently sponsored by the federal agencies, such as the Mutual Help Program (housing program) and special education classes for Indian children, could be jeopardized. Consequently, additional financial needs as a result of synfuels development would increase stress upon the tribe's ability to support the reservation's needs. This would especially affect the unemployed, those living on fixed incomes, and the elderly.

The reservation would also experience inflation as a result of synfuels development. The Ute Tribe relies on goods and services from off-reservation areas. Therefore, any economic fluxes in the region would be felt to some extent on the reservation.

Synfuels development would also reduce the autonomy of the Indian tribe and increase the interaction between non-Indians and Indians.

Other Socioeconomic Impacts

Agriculture

With the development of the applicants' proposed projects and associated community expansions, 11,028 acres of land now being used for crop production would be lost. This loss would have a moderate adverse effect on the local agricultural sector within the area of influence. Estimates of the total valuation of crop loss have been made based on calculated acreage losses for specific crops and per unit estimates of each type of crop. Crop valuations were obtained from the Utah State Department of Agriculture. In 1986, the estimated crop loss due to the applicants' projects would be $1.5 million (1980 dollars). In 1995, the loss is estimated to be $2.5 million. Adding interrelated projects to the impact analysis increases 1985 losses to $1.6 million. In 1995, total losses would be $3.4 million. The greatest loss would be in the displacement of alfalfa hay production. Refer to Section R-4.A.6, Agriculture, for a more detailed discussion of the impacts to the agricultural sector.

Though agricultural land displacement would occur, the value of the land used formerly for agriculture would increase substantially. Thus, ranchers and farmers would receive higher prices in the sale or lease of their properties.

Hunting, Fishing, and Nonconsumptive Wildlife Use Expenditure

Based on information supplied by the Utah Division of Wildlife Resources, the estimated increases in expenditures from hunting in 1985 would be $2,430,365 (1980 dollars) as a result of the population increases that would result from implementation of the applicants' proposed projects. In 1995, the estimated increase would be $4,540,453. Adding the effects of the interrelated projects, estimated expenditures would be $2,657,721 and $6,200,811, respectively.

For nonconsumptive uses of wildlife, the estimated expenditure increase would be $453,868 in 1985 as a result of the applicants' projects; in 1995, the value would be $848,042. Adding the effects of the interrelated projects, estimated expenditures would be $496,607 and $1,158,225, respectively.

Fishing-related expenditures would increase by $6,563,846 in 1985 due to the applicants' projects. By 1995, this increased expenditure over baseline would be $12,265,420. When including the interrelated projects, increases would be $7,182,606 and $16,752,428, respectively.

Though expenditures would increase, the overall usage of wildlife and removal of habitat could reduce the wildlife population to the extent that the number of persons involved in consumptive and nonconsumptive uses of wildlife would be reduced. This could, in turn, reduce potential economic benefits to wildlife in the long-term. (Refer to Section R-4.A.5, Wildlife, for a more detailed discussion of the impacts to wildlife.)

Quality of Life

The local social changes associated with the projected population growth would be very significant. This growth would occur primarily in Uintah and Duchesne counties and the communities of Roosevelt, Vernal, and other Ashley Valley towns. Construction period and operation period growth in Uintah and Duchesne counties and the Colorado area, which would result in widespread and intensive local social consequences, are covered in this section.

The method used to project the local social changes caused by these growth levels is based on three main sources of information. These are: (1) population projections, (2) literature on rapid-growth communities in the West, and (3) direct interviews with residents and officials in Vernal, Uintah County, and the State of Utah. General patterns of change experienced elsewhere were established through literature search. The informed judgments of area residents and documentation of unique local conditions were used to modify (given the evidence acquired locally and through published reports) the general patterns of changes.

HIGH-LEVEL SCENARIO-SOCIOECONOMICS

Population growth could lead to more local governmental formality and regulation simply because of growth pressures. Local units of government could require more outside professional help in dealing with growth-related problems (Mountain West Research 1982). Coordination between authorities at the state, county, and municipal levels would be required, along with the cooperation of private-sector industrial firms.

The affected communities would become further segmented and diverse (Mountain West Research 1982). Length of residence, occupation, religious preference, and similar characteristics would become even more influential factors in defining relations among residents. Differences in values and experiences between some newcomers and long-term residents could cause animosity and mistrust.

Retail expansion could enhance employment opportunities for local women who may have limited job experience. This economic activity could also lead to substantial numbers of young residents leaving local high schools to enter the job market (Mountain West Research 1982). This is already occurring in the area because of oil and gas activity and could be further accelerated with additional projects (BLM 1982c).

At present, Vernal and other Ashley Valley communities and Roosevelt are rapidly changing toward more urban atmospheres. Residents, particularly women and the elderly, would have less feelings of security as larger numbers of young men entered the area (Mountain West Research 1982). Impersonalization of community life would become more evident.

Stress attached to residence in a rapid-growth area would be widespread. It likely would be more evident among newcomers, particularly women, than it would be among long-term residents. This increased level of stress and uncertainty would be reflected in higher levels of reported crime, although increases in property crime likely would be greater than crimes against persons. Increase in crime likely would be at, or in excess of, increases in population levels (Mountain West Research 1982).

Family instabilities (including child neglect and abuse, dissolutions, and conflict between spouses) would be more evident, particularly in residential living environments (such as mobile home parks) with limited space, lack of privacy, and few amenities. Shortfalls in available housing (supply, variety, and without excessive costs) would intensify these problems (Mountain West Research 1982).

While housing supply shortfalls could have major local social consequences, availability of other services and facilities also would be important in the adaptation of communities and individuals to rapid growth. Quality of education could suffer if physical plants, personnel, and maintenance funds are not available in a timely manner. Health care is typically a problem in such settings as well. Deficits in facilities, personnel, and particularly emergency care treatment could cause genuine hardships. Mental health

services, already pressured in the area of influence, could be critical in reducing some of the adaptive problems encountered by individuals. Timely availability of such services, along with housing, education, and health care, would almost certainly reduce the instabilities often associated with rapid growth.

In general, these effects would be most immediate and intense for newcomers who would lack resources to deal with them. However, as construction nears completion and the proposed facilities become operational, the local social environment would become more stable and predictable.

Around the year 1995, the communities of Roosevelt, Vernal, and other Ashley Valley towns would have been more or less permanently changed by this level of growth. Higher population levels and densities, more diverse populations, and the entry-exit of many persons would cause this region to become less personal, more segmented, more stressful, and faster-paced, and what remains of a small town, rural atmosphere largely would be lost. To some extent, these processes have already begun and would occur independently of synfuels development because of national changes and local oil and gas development. However, they would be much more intense, rapid, and widespread should the synfuels-related level of growth take place.

The siting of construction camps in the Bonanza (Uintah County) area by 1985 would significantly reduce the population pressure on existing communities. Distance alone would alleviate some of the disruptions that might otherwise be attributable to the presence of large numbers of temporary workers. However, given the expected age (mostly young) and sex (mostly male) composition of a construction camp environment (Mountain West Research 1982), a fairly rowdy atmosphere might develop in the Bonanza area during construction. Prostitutes would be attracted to the area, even though they may locate in established communities (BLM 1982). Drinking, bickering, gambling, drug use, possession of weapons, and similar behaviors are expected under these conditions (regardless of company policies), but long-term residents would be less exposed (except on weekends) to these behaviors than they would be without construction camps (BLM 1982c).

Another potential effect that would not occur in Vernal but that could adversely affect the quality of life in outlying residential areas is noise pollution. The Sohio project, by being sited so close to Vernal, could result in the residents of unincorporated areas to the immediate west of Vernal having to endure relatively high levels of industrial noise.

Relative to Roosevelt, Vernal, and other Ashley Valley communities, the local social changes attributable to the applicants' proposed projects in Daggett and Grand counties (Utah) and the Rangely (Colorado) area are expected to be limited. The population growth levels would not be as high.

The placement of large-scale industrial facilities in the region is not expected to have large-scale direct effects on residents of the Uintah and Ouray Indian Reservation. This is due to projected residential location patterns. However, off-reservation development and resulting employment and

income increases would lead to further divergence between on and off-reservation living conditions. Additional interracial stresses, resentments, and frustrations would be expected under these circumstances.

For some Ute Tribe members, in particular, along with some non-Indians who likely would not participate in the benefits of local economic activity, these changes would result in a heightened sense of economic isolation and poverty. While psychological in nature, the effects would be genuine and widespread on the reservation.

Residents of the reservation would also experience the stresses placed upon those local services and facilities that are shared with local non-Indians. Roosevelt would be the notable location in which such service delivery capacities would be exceeded.

Loss of sense of security, further depersonalization, and similar changes which are expected to occur in the area of influence as a whole would also be evident among some Ute tribe members.

R-4.A.2 AIR QUALITY

Air quality impact concerns related to the applicants' oil shale and tar sand development include: (1) whether maximum ground level concentrations of regulated pollutants would be within state and national ambient air quality standards (NAAQS) and prevention of significant deterioration (PSD) increments; (2) visibility impairment; (3) wet and dry acid deposition; and (4) impacts on air quality related values in PSD Class I protected national parks and wilderness areas, or other PSD Class II areas of special concern, such as national monuments, Ute Indian lands, and wilderness study areas. There is also concern about secondary air quality impacts associated with growth in residential and commercial areas and related activities.

The analysis of regional air quality impacts is a complex one complicated by uncertainties in synfuel emission control technology, amounts and kinds of pollutants that would be emitted from commercial scale synfuel processing, a limited meteorological data base, and the need to look at impacts close to a facility as well as on a subregional and a regional scale. Such an analysis strains the state of the art in atmospheric dispersion modeling.

System's Applications Inc. conducted an air quality analysis for BLM to address air quality concerns. The Air Quality Technical Report (Systems Applications Inc. 1982) provides the supporting documentation for this EIS.

The analysis used a multiple model approach to assess primary and secondary air quality impacts of pollution emissions from the applicants' proposed synfuels projects as well as other existing and proposed developments which might interact in a cumulative way with the synfuel proposals.

There is no universally accepted or approved model for complex terrain or regional scale modeling. The methodology selected was based on the utilization of several component air quality models as discussed in Appendix R-G.

The analysis presents a range of possible concentration values for total suspended particulates and sulfur dioxide, with the upper bound set by the GPM model values and the lower bound set by rationale discussed in Appendix R-G and in greater detail in the Air Quality Technical Report (System Applications Inc. 1982). It is assumed that the true value lies somewhere in between these two bounds.

Predicted ground-level concentrations were compared with the appropriate air quality standards (PSD and NAAQS) for purposes of assessing the significance or insignificance of impacts. The results of the analysis are shown in Tables R-4-7 through R-4-9 for the sulfur dioxide 3-hour, 24-hour, and annual standards, respectively, and Tables R-4-10 and R-4-11 for the total suspended particulates 24-hour maximum and annual average predicted concentrations, respectively. The values represent both direct source impacts of the emissions from the proposed facilities and secondary source impacts from the influence of population growth and related activities associated with the proposed developments. Each range of values shown represent the highest determined concentration, irrespective of time of year at the receptors within the boundaries of the area being analyzed (for example Dinosaur National Monument, Flat Tops Wilderness Area, or the Uintah and Ouray Indian Reservation). Isopleth maps concentration distributions over the region are presented in the Air Quality Technical Report (Systems Applications Inc. 1982).

Sulfur Dioxide

Combined Applicants' Impacts

As it can be seen from the values in Tables R-4-7 through R-4-9, the predicted sulfur dioxide values are all within the applicable Class I or Class II increment limitations. The highest value calculated for the Uintah Basin was approximately one-half of the allowable Class II increments. The State of Colorado Category I limitations, which carry the same sulfur dioxide increments as the federal PSD Class I (Section R-3.A.2, Air Quality) could be exceeded in Dinosaur and Colorado National Monuments if the upper value is considered. As shown in the Air Quality Technical Report (Systems Applications Inc.), the sulfur dioxide concentration increases to Dinosaur and Colorado National Monuments would be largely from the conceptual projects (Sohio and Geokinetics, respectively), whereas the Uintah and Ouray Indian Reservation lands would be about equally affected from the site-specific and conceptual projects. In all cases, sulfur dioxide impacts from secondary emission sources represent a very small portion of the total sulfur dioxide impact.

Incremental sulfur dioxide limitations of the Class I Flat Tops area would not be exceeded by the applicants' proposed projects.

TABLE R-4-7

SUMMARY OF MAXIMUM 3-HOUR AVERAGE SO_2 CONCENTRATIONS (ug/m^3)
High-level Scenario

	Increment Consumption Above Baseline			Total Ambient Concentrations Including Baseline	
	Applicants' Site-Specific and Conceptual Projects	Applicants' and Interrelated Projects	Baseline	Applicants' Site-Specific and Conceptual Projects	Applicants' and Interrelated Projects
Population Centers					
Vernal	5-49	6-59	5-45	10-94	11-104
Green River	1-7	1-11	0-4	1-11	1-15
Rangely	2-22	4-50	0-1	2-23	4-51
Meeker	2-12	10-94	2-16	4-28	12-110
Craig	1-8	13-129	20-196	21-204	33-325
Glenwood Springs	1-7	2-17	1-9	2-16	3-26
Rifle	1-9	2-19	2-19	3-28	4-38
Parachute	1-9	8-79	2-21	3-30	10-100
DeBeque	1-13	2-23	5-52	6-65	7-75
Grand Junction	5-47	6-57	60-607	65-654	66-664
Existing Class I Area and Other Areas of Special Concern					
Flat Tops Wilderness Area	1-8	9-89a	4-39	5-47	13-128
Mt. Zirkel Wilderness Area	1-6	3-26a	0-3	1-9	3-29
Dinosaur National Monument	14-133b	15-149b	1-5	15-138	16-154
Colorado National Monument	5-46b	6-56b	32-318	37-364	38-374
Uintah and Ouray Indian Reservation	28-280	30-308	19-185	47-465	49-493
High Uintas Wilderness Area (proposed)	1-11	1-11	0-1	1-12	1-12
Class II Area Receptor with Maximum Impact from Direct Source Emission In Uintah Basin	28-280	30-308	19-185	47-465	49-493
Ambient Air Quality Standard or Prevention of Significant Deterioration Increment					
PSD Class I Increment 25	A	A	NA	NA	NA
PSD Class II Increment 512	A	A	NA	NA	NA
NAAQS 1,300	NA	NA	A	A	A

NOTE: SO_2=sulfur dioxide; PSD=Prevention of Significant Deterioration; NAAQS=National Ambient Air Quality Standard; A=Standard or increment is applicable; NA= Standard or increment is not applicable.

[a]Indicates violation of applicable standard or increment.

[b]Indicates violation of increment if monument is redesignated Class I.

TABLE R-4-8

SUMMARY OF MAXIMUM 24-HOUR AVERAGE SO_2 CONCENTRATIONS (ug/m^3)
High-level Scenario

	Increment Consumption Above Baseline			Total Ambient Concentrations Including Baseline	
	Applicants' Site-Specific and Conceptual Projects	Applicants' and Interrelated Projects	Baseline	Applicants' Site-Specific and Conceptual Projects	Applicants' and Interrelated Projects
Population Centers					
Vernal	1-13	1-15	1-6	2-19	2-21
Green River	0-2	0-3	0-1	0-3	0-4
Rangely	0-4	0-7	0-1	0-5	0-8
Meeker	0-3	1-18	1-5	1-8	2-23
Craig	0-2	2-17	3-28	3-30	5-45
Glenwood Springs	0-2	2-14	0-2	0-4	2-16
Rifle	0-2	1-8	0-3	0-5	1-11
Parachute	0-3	3-33	0-3	0-6	3-36
DeBeque	0-3	0-6	1-11	1-14	1-17
Grand Junction	1-7	1-8	8-82	9-89	9-90
Existing Class I Area and Other Areas of Special Concern					
Flat Tops Wilderness Area	0-2	1-12a	1-5	1-7	2-17
Mt. Zirkel Wilderness Area	0-1	0-3	0-1	0-2	0-4
Dinosaur National Monument	1-13b	1-14b	1-5	2-18	2-19
Colorado National Monument	0-6b	0-7b	4-40	4-46	4-47
Uintah and Ouray Indian Reservation	5-55	5-60	2-23	7-78	7-83
High Uintas Wilderness Area (proposed)	0-4	0-4	0-1	0-5	0-5
Class II Area Receptor with Maximum Impact from Direct Source Emission In Uintah Basin	5-46	5-50	0-1	5-47	5-51
Ambient Air Quality Standard or Prevention of Significant Deterioration Increment					
PSD Class I Increment 5	A	A	NA	NA	NA
PSD Class II Increment 91	A	A	NA	NA	NA
NAAQS 365	NA	NA	A	A	A

NOTE: SO_2=sulfur dioxide; PSD=Prevention of Significant Deterioration; NAAQS=National Ambient Air Quality Standard; A=Standard or increment is applicable; NA= Standard or increment is not applicable.

[a]Indicates violation of applicable standard or increment.

[b]Indicates violation of increment if monument is redesignated Class I.

TABLE R-4-9

SUMMARY OF ANNUAL AVERAGE SO_2 CONCENTRATIONS (ug/m^3)
High-level Scenario

	Increment Consumption Above Baseline			Total Ambient Concentrations Including Baseline	
	Applicants' Site-Specific and Conceptual Projects	Applicants' and Interrelated Projects	Baseline	Applicants' Site-Specific and Conceptual Projects	Applicants' and Interrelated Projects
Population Centers					
Vernal	0-1	0-1	0	0-1	0-1
Green River	0	0	0	0	0
Rangely	0-1	0-1	0	0-1	0-1
Meeker	0	0-1	0	0	0-1
Craig	0	0	0	0	0
Glenwood Springs	0	0	0	0	0
Rifle	0	0-1	0-1	0-1	0-2
Parachute	0	0-1	0-1	0-1	0-2
DeBeque	0	0-1	0-1	0-1	0-2
Grand Junction	0	0-1	0-9	0-9	0-10
Existing Class I Area and Other Areas of Special Concern					
Flat Tops Wilderness Area	0	0-1	0	0	0-1
Mt. Zirkel Wilderness Area	0	0	0	0	0
Dinosaur National Monument	0-1	0-1	0	0-1	0-1
Colorado National Monument	0	0	0-1	0-1	0-1
Uintah and Ouray Indian Reservation	0-2	0-2	0	0-2	0-2
High Uintas Wilderness Area (proposed)	0	0	0	0	0
Class II Area Receptor with Maximum Impact from Direct Source Emission In Uintah Basin	1-4	1-4	0	1-4	1-4
Ambient Air Quality Standard or Prevention of Significant Deterioration Increment					
PSD Class I Increment 2	A	A	NA	NA	NA
PSD Class II Increment 20	A	A	NA	NA	NA
NAAQS 80	NA	NA	A	A	A

NOTE: SO_2=sulfur dioxide; PSD=Prevention of Significant Deterioration; NAAQS=National Ambient Air Quality Standard; A=Standard or increment is applicable; NA= Standard or increment is not applicable.

[a]Indicates violation of applicable standard or increment.

[b]Indicates violation of increment if monument is redesignated Class I.

TABLE R-4-10

SUMMARY OF MAXIMUM 24-HOUR AVERAGE TSP CONCENTRATIONS (ug/m^3)
High-level Scenario

		Increment Consumption Above Baseline			Total Ambient Concentrations Including Baseline	
		Applicants' Site-Specific and Conceptual Projects	Applicants' and Interrelated Projects	Baseline	Applicants' Site-Specific and Conceptual Projects	Applicants' and Interrelated Projects
Population Centers						
Vernal		186a-756a	246a-997a	185a-740a	371a-1,496a	431a-1,737a
Green River		5-25	6-29	38-150a	43-175a	44-179a
Rangely		93a-389a	254a-1,039a	135-540a	228a-929a	389a-1,579a
Meeker		0-5	147a-636a	110-440a	110-445a	257a-1,076a
Craig		0-1	12-61	190a-760a	190a-761a	202a-821a
Glenwood Springs		0-1	41a-171a	110-450a	110-451a	151a-621a
Rifle		0-1	102a-421a	300a-1,200a	300a-1,201a	402a-1,621
Parachute		0-4	136a-554a	235a-940a	235a-944a	371a-1,494a
DeBeque		1-7	62a-257a	120-480a	121-487a	182a-737a
Grand Junction		1-7	122a-497a	310a-1,200a	311a-1,207a	432a-1,697a
Existing Class I Area and Other Areas of Special Concern						
Flat Tops Wilderness Area		0-2	24a-107a	75-300a	75-302a	99-407a
Mt. Zirkel Wilderness Area		0-2	10a-46a	30-110	30-112	40-156a
Dinosaur National Monument		64a-276a	84-357a	100-400a	164a-676a	184a-757a
Colorado National Monument		1-9	32b-139a	80-320a	81-329a	112a-459a
Uintah and Ouray Indian Reservation		167a-1,044a	203a-1,196a	125-500a	292a-1,544a	328a-1,696a
High Uintas Wilderness Area (proposed)		0-5	0-5	25-110	25-115	25-115
Class II Area Receptor with Maximum Impact from Direct Source Emission In Uintah Basin		167a-1,044a	204a-1,195a	90-360a	257a-1,404a	294a-1,555a
Ambient Air Quality Standard or Prevention of Significant Deterioration Increment						
PSD Class I Increment	10	A	A	NA	NA	NA
PSD CLASS II Increment	37	A	A	NA	NA	NA
NAAQS	150/260	NA	NA	A	A	A

NOTE: SO_2=sulfur dioxide; PSD=Prevention of Significant Deterioration; NAAQS=National Ambient Air Quality Standard; A=Standard or increment is applicable; NA= Standard or increment is not applicable.

[a]Indicates violation of applicable standard or increment.

[b]Indicates violation of increment if monument is redesignated Class I.

TABLE R-4-11

SUMMARY OF ANNUAL AVERAGE TSP CONCENTRATIONS (ug/m^3)
High-level Scenario

	Increment Consumption Above Baseline			Total Ambient Concentrations Including Baseline	
	Applicants' Site-Specific and Conceptual Projects	Applicants' and Interrelated Projects	Baseline	Applicants' Site-Specific and Conceptual Projects	Applicants' and Interrelated Projects
Population Centers					
Vernal	40a-161a	55a-221a	45-180a	85a-341a	100a-401a
Green River	2-6	3-8	10-40	12-46	13-48
Rangely	20a-84a	60a-244a	30-120a	50-204a	90a-364a
Meeker	0	31a-127a	30-120a	30-120a	61a-247a
Craig	0	5-21a	45-180a	45-180a	50-201a
Glenwood Springs	0	8-33a	30-120a	30-120a	38-153a
Rifle	0	25a-101a	70a-280a	70a-280a	95a-381a
Parachute	0	30a-121a	55-220a	55-220a	85a-341a
DeBeque	0	15-61a	30-120a	30-120a	45-181a
Grand Junction	0	30a-121a	70a-280a	70a-280a	100a-401a
Existing Class I Area and Other Areas of Special Concern					
Flat Tops Wilderness Area	0	5a-21a	20-80a	20-80a	25-101a
Mt. Zirkel Wilderness Area	0	2-11a	10-40	10-40	12-51
Dinosaur National Monument	5b-61a	20a-81a	25-1002	40-161a	45-181a
Colorado National Monument	0	8b-33a	20-80a	20-80a	28-113a
Uintah and Ouray Indian Reservation	24a-106a	30a-130a	35-140a	59-246a	65a-270a
High Uintas Wilderness Area (proposed)	0	0	10-40	10-40	10-40
Class II Area Receptor with Maximum Impact from Direct Source Emission In Uintah Basin	27a-145a	33a-169a	35-140a	62-285a	68a-309a
Ambient Air Quality Standard or Prevention of Significant Deterioration Increment					
PSD Class I Increment 5	A	A	NA	NA	NA
PSD Class II Increment 19	A	A	NA	NA	NA
NAAQS 60/75	NA	NA	A	A	A

NOTE: SO_2=sulfur dioxide; PSD=Prevention of Significant Deterioration; NAAQS=National Ambient Air Quality Standard; A=Standard or increment is applicable; NA= Standard or increment is not applicable.

[a]Indicates violation of applicable standard or increment.

[b]Indicates violation of increment if monument is redesignated Class I.

Considering the effects of the combined applicants' projects, all sulfur dioxide impacts are calculated to be sigificantly below the NAAQS standards and, therefore, no significant impacts to health and welfare would be expected.

Regional Cumulative Impacts

The point sources considered in the regional cumulative analysis are shown on Figure R-4-1. These interrelated sources include eleven oil shale facilities in Colorado producing a total of 639,000 barrels per stream day. The primary purpose was to consider potential downwind circulative effects in areas of concern, including the Flat Tops Wilderness Area.

Tables R-4-7 through R-4-9 summarize the total sulfur dioxide impacts from regional cumulative sources for a variety of receptors of interest. Maximum 3-hour and 24-hour concentrations as well as annual average concentrations are provided.

The analysis indicates that the Class I Flat Tops and Mount Zirkel Wilderness Areas could be affected. The range of values calculated for these two areas extends above and below the allowable Class I increments for both the 3-hour and 24-hour standards; therefore, it is possible that significant impacts could occur. From a regulatory standpoint, it would be at the discretion of the federal land manager (in this case the Forest Service) to determine the adversity of the impact. The assessment of the effects on air quality related values (including visibility) would be made by the Forest Service during any PSD permitting process. The major contribution to the impact at the Flat Tops and Mount Zirkel Wilderness Areas is from the oil shale development scenario assumed for Colorado. There is the same probability that the Colorado Category I designations for the Dinosaur National Monument would be exceeded, because the sulfur dioxide increment limitations are the same as federal Class I standards.

Predicted sulfur dioxide impacts throughout the remainder of the region would be within PSD incremental limitations. Predicted concentrations are also substantially below the respective NAAQS limitations, and, therefore, no significant impacts to health or welfare would be expected.

Total Suspended Particulates

Combined Applicants' Impacts

Considering the combined applicants' projects, impacts from total suspended particulates would be significant, resulting primarily from secondary emission sources (population growth and related activities such as travel on unpaved roads). One exception would be the Sohio tar sand project where total suspended particulates impacts would be in excess of the Class II increment of 37 micrograms per cubic meter (ug/m^3) a distance away from the plant site at locations that may be outside of the property boundary. As seen from the data in Tables R-4-10 and R-4-11, Class II increment limitations could be exceeded

in the Dinosaur National Monument and the Uintah and Ouray Indian Reservation. The impacts to Dinosaur National Monument would be largely from secondary particulate emission sources, whereas impacts to the Uintah and Ouray Indian Reservation would be the result of both primary particulate emissions from the synfuels facilities and secondary emissions. Both the 24-hour maximum and annual average incremental limiations could be exceeded in these areas. The towns of Vernal and Rangely also would be significantly affected.

The secondary area emission sources (principally from unpaved and gravel roads) dominate the total impact as shown in Table R-4-12. If secondary emissions from additional vehicles on unpaved roads associated with development-induced population growth are included in the PSD increment consumption, PSD Class II increments for total suspended particulates would be exceeded in many areas throughout the area of influence. From a regulatory standpoint, this would be decided by EPA or the states during the PSD permitting process. A recent notice in the Federal Register (June 25, 1982, page 27,554) indicated that "secondary emissions do not include any emissions which come directly from a mobile source." If just the direct particulate emissions from the applicants' proposed projects are considered to consume the PSD increment, and secondary emissions are excluded, it is quite likely that PSD Class II increments for TSP would not be consumed or exceeded in the region except for the area near Sohio's conceptual tar sand facility as previously noted.

The NAAQS particulate limitations for both the short-term and long-term standards would also be exceeded. In the majority of the areas considered, these limitations are already exceeded, largely from windblown dusts, and synfuels development would increase these levels.

The closest downwind Class I area (Flat Tops Wilderness Area) would not be significantly affected.

Regional Cumulative Impacts

Tables R-4-10 and R-4-11 summarize the cumulative total suspended particulates impacts of regional emission sources. Secondary total suspended particulates area emission sources (principally emissions from dirt roads) dominate the cumulative impact. Particulates from the synfuel facilities and other sources make a small contribution to the total impact. If secondary emissions from additional vehicles on dirt roads associated with development in direct proportion to population growth are included in the PSD increment consumption, PSD Class II increments for total suspended particulates would be exceeded in many areas throughout the area of influence. The Class I increments in the Flat Tops Wilderness Area would be exceeded. If just the direct total suspended particulates emissions from the synfuels facilities are considered in the PSD increment, it is quite likely that given the range of impacts calculated, PSD Class I and II increments for total suspended particulates would not be consumed or exceeded in the region.

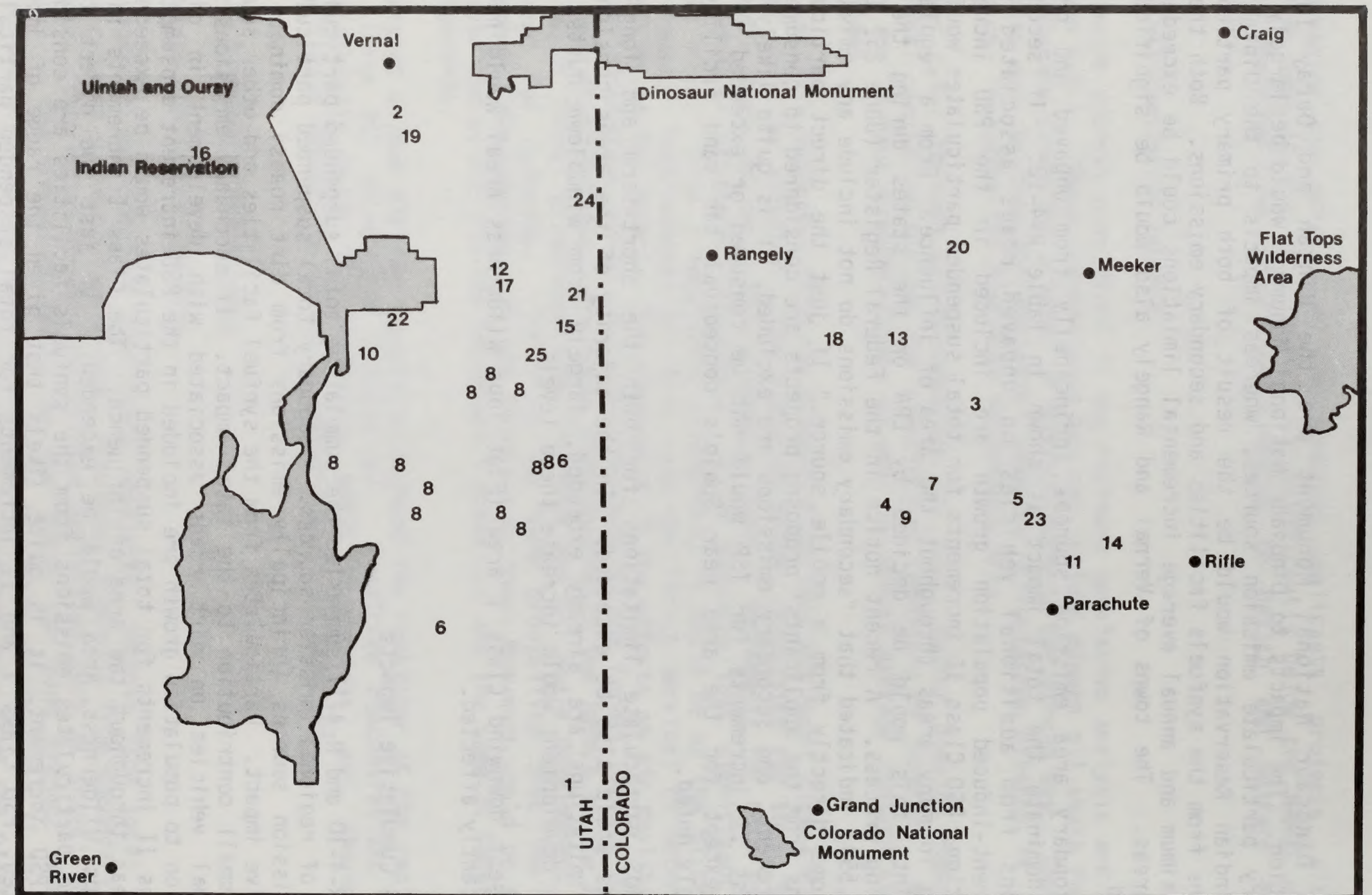


FIGURE R-4-1 LOCATIONS OF POINT SOURCES, TOWNS AND MANDATORY AND POTENTIAL CLASS I AREAS IN THE AREA OF INFLUENCE

NOTE: Numbers refer to point sources identified on legend located on next page.

LEGEND FOR FIGURE R-4-1

Site Number	Project	Applicants' Proposed Project	Interrelated Project Uintah Basin	Interrelated Project Piceance Basin
1	Baker		X	
2	C and A Tar Sand		X	
3	Cathedral Bluff, (C-b site)			X
4	Chevron			X
5	Colony, (C-a site)			X
6	Enercor-Mono Power	X		
7	Exxon			X
8	Geokinetics	X		
9	Getty			X
10	Magic Circle	X		
11	Mobil			X
12	Bonanza Power Plant		X	
13	Multimineral			X
14	Naval Oil Shale			X
15	Paraho	X		
16	Plateau Refinery		X	
17	Ramax		X	
18	Rio Blanco			X
19	Sohio	X		
20	Superior			X
21	Syntana	X		
22	Tosco	X		
23	Union			X
24	Western Tar Sand		X	
25	White River Shale (U-a,U-b site)		X	

TABLE R-4-12

SUMMARY OF PRIMARY AND SECONDARY MAXIMUM 24-HOUR AVERAGE TSP CONCENTRATIONS (ug/m^3)
High-Level Scenario

	Applicants Site-Specific Projects		Applicants' Conceptual Projects		Interrelated Projects Uintah Basin		Interrelated Projects Piceance Basin	
	Direct	Secondary	Direct	Secondary	Direct	Secondary	Direct	Secondary
Population Centers								
Vernal	0-2	125a-500a	1-14	60a-240a	0-1	60a-240a	0	0
Green River	0-1	3-12	0-4	2-8	0	1-4	0	0
Rangely	1-12	60a-240a	2-17	30-120a	0-2	30-120a	1-10	130a-520a
Meeker	0-2	0	0-3	0	0-1	0	7-70a	140a-560a
Craig	0-1	0	0	0	0	0	2-20	10-40a
Glenwood Springs	0-1	0	0	0	0	0	1-10	40a-160a
Rifle	0-1	0	0	0	0	0	2-20	100a-400a
Parachute	0-1	0	0-3	0	0	0	1-10	135a-540a
DeBeque	0-1	0	1-6	0	0	0	1-10	60a-240a
Grand Junction	0-1	0	1-6	0	0	0	1-10	120a-480a
Existing Class I Area and Other Areas of Special Concern								
Flat Tops Wilderness Area	0-1	0	0-1	0	0	0	2-17a	22a-88a
Mt. Zirkel Wilderness Area	0-1	0	0-1	0	0	0	0-4	10a-40a
Dinosaur National Monument	1-6	40a-160a	3-30b	20b-80a	0-1	20b-80a	0	0
Colorado National Monument	0-2	0	1-7	0	0	0	1-10b	30b-120a
Uintah and Ouray Indian Reservation	17-171a	70a-280a	45a-453a	35-140a	0-2	35-140a	1-10	0
High Uintas Wilderness Area (proposed)	0-1	0	0-4	0	0	0	0	0
Class II Area Receptor with Maximum Impact from Direct Source Emission In Uintah Basin	1-11	70a-280a	61a-613a	35-140a	0-1	35-140a	1-10	0
Ambient Air Quality Standard or Prevention of Significant Deterioration Increment								
PSD Class I Increment 10	A	A	A	A	A	A	A	A
PSD Class II Increment 37	A	A	A	NA	NA	A	NA	A
NAAQS 150/260	NA	NA	NA	NA	NA	NA	NA	NA

NOTE: SO_2=sulfur dioxide; PSD=Prevention of Significant Deterioration; NAAQS=National Ambient Air Quality Standard; A=Standard or increment is applicable; NA= Standard or increment is not applicable.

[a]Indicates violation of applicable standard or increment.

[b]Indicates violation of increment if monument is redesignated Class I.

As shown in Tables R-4-10 and R-4-11, the ambient air quality standards are presently exceeded in many locations throughout the region, largely due to windblown dusts. The calculated values from the applicants' proposed projects would significantly aggravate these levels and health and welfare impacts cannot be ruled out. It should be noted, however, that much of the impact is estimated to be from dusts created by vehicular activity. These larger particles are generally not respirable to the degree that finer particles from processing facilities are.

Other Pollutants

Other criteria pollutants, including nitrogen oxides, carbon monoxide, hydrocarbons (both reactive and nonreactive) and ozone, were analyzed and impacts were determined to be insignificant when considering the combined applicants' projects and when considering the cumulative effects of the applicants' projects and interrelated projects (Systems Applications Inc. 1982).

Emissions of other pollutants that may be characteristic of oil shale or tar sand processing, such as trace elements and hydrocarbons, are also of potential concern. Such pollutants as arsenic, beryllium, cadmium, chromium, mercury, nickel, lead, selenium, vanadium, and polycyclic aromatic hydrocarbons (PAH), among others, would be expected in one or more of the proposed synfuels mining, retorting, and upgrading processes and could have an impact on the environment.

Due to the relatively early stages of development of oil shale and tar sand technologies, only limited data are available regarding the release of these pollutants. A preliminary study done for the Health and Environmental Risk Analysis Program of the Department of Energy (IWG 1981) considered the health effects asociated with a one million barrel per day oil shale industry in Colorado and Utah (similar to the level considered in this EIS). Preliminary results indicated that increased levels of arsenic, cadmium, mercury, nickel, lead, and selenium would be insignificant when compared to background values. No health effect potential was found for exposure to fluoride, mercury, lead, selenium or vanadium. The possibility of increased cancer was studied for exposure to arsenic, nickel, chromium, cadmium, and polycyclic hydrocarbons. It was estimated that increases in cancer rates would be less than one-hundredth of a cancer per year. The study is continuing and additional results should be available in the near future.

Another recent study (Daniels, Anspaugh, Ricker 1981) assessed the potential health and ecosystem effects from air pollutants resulting from conceptual commerical surface and in-situ facilities producing 20,000 bpsd (tar sand facilities addressed in this EIS range from 5,000 to 50,000 bpsd). The study examined potential emissions of the criteria pollutants (sulfur dioxide, total suspended particulates, nitrogen oxides, total hydrocarbons, carbon monoxide) as well as hydrogen sulfide. The conclusions of the study were that public health and ecosystem effects could occur, but they would be localized and/or controllable. The study recognized the uncertainties of the data base for the analysis and recommendation for studies to determine complete chemical

characterization of emissions and specific control technologies that would be effective in protecting air quality from pollutants emitted by commercial tar sand facilities.

Visibility Impairment

The applicants' proposed projects could cause visibility impairment as a result of emissions of particulate matter, sulfur dioxide (which is converted in the atmosphere to sulfate aerosol), and nitric oxide (which is converted to nitrogen dioxide). Particulate matter (both primary emissions and secondary aerosol) scatters light causing white or gray plumes, reducing the contrast of terrain features, and reducing visual range. Nitrogen dioxide discolors the sky, causing yellow or brown hazes. The judgment as to whether projected effects are adverse or not is subjective, since there are no specific criteria for judging adversity.

A series of visibility analyses (discussed in more detail in Appendix R-G) were performed for maximum emissions for each facility associated with the high-level scenario in the Uintah and Piceance basins to identify the possibility of potentially adverse visibility impairment occurring in four areas of concern: the Flat Tops Wilderness Area, Dinosaur and Colorado National Monuments (two areas that potentially could be redesignated Class I), the Uintah and Ouray Indian Reservation, and the proposed High Uintas Wilderness Area. The results of the analysis indicated that significant local reductions in visual range could be observed in stagnant haze layers, principally in the winter. These hazes would be caused by particulate emissions from industrial facilities, windblown dust, dust from roadways, and smoke from residential wood stoves and fireplaces. Such hazes would be infrequent and localized and would not affect regional visibility and views in the Flat Tops Wilderness Area. Worst-case reductions in regional visual range are anticipated to occur in the summer when sulfate formation rates are highest.

Visual range reduction is projected to be less than 10 percent when viewed from the Flat Tops Wilderness Area (Table R-4-13) and would be principally due to sulfate aerosol formed in the atmosphere from regional sulfur dioxide emissions from synfuel facilities and power plants. The predicted high total suspended particulate concentrations from secondary emissions would not be expected to greatly reduce regional visibility but would cause local dust clouds. Yellow-brown atmospheric plume discoloration from the vicinity of synfuel facilities would be visible from 5 to 50 days per year depending on the perceptibility threshold of the viewing individual. This would occur primarily on mornings with clear, light-wind and stable conditions in the vicinity of the synfuel facilities. Afternoon occurrence would be less frequent.

TABLE R-4-13

WORST-CASE REDUCTION OF VISUAL RANGE FOR A VIEW FROM
FLAT TOPS WILDERNESS AREA LOOKING TOWARD THE NORTHWEST
High-level Scenario

Source	Year 1980 Baseline Percent	High-Level Scenario Percent
Applicants' Proposed Projects	0.00	2.28
Interrelated Projects		
Other Uintah Basin point sources	0.45	1.56
Piceance Basin oil shale	0.00	1.64
Other Piceance Basin point sources	1.96	2.97
Uintah County area sources[a]		
5 um aerosol	0.04	0.12
10 um aerosol	0.17	0.54
Rio Blanco County area sources[a]		
5 um aerosol	0.03	0.03
10 um aerosol	0.15	0.15
Moffat County area sources[a]		
5 um aerosol	0.01	0.03
10 um aerosol	0.05	0.15
Total visual range reduction	2.86 percent	9.48 percent

Source: Systems Applications Inc. 1982.

Note: um = micrometers

[a]Only particulate emissions from unpaved roads, which are more than 90 percent of total particulates emissions, were considered in the visibility analysis.

Acid Deposition

The potential impact of acid deposition in such forms as sulfurous, sulfuric, and nitric acid through both wet and dry processes is currently of growing concern. However, very little is presently known about the atmospheric chemistry, transport, deposition and environmental effects of acid deposition.

What is presently known about acid deposition:

1. Most acids in precipitation are sulfuric and nitric acids.

2. Sulfuric and nitric acids are formed by atmospheric chemical conversion of sulfur dioxide and nitrogen oxides to sulfates and nitrates.

3. Primary sources of sulfur dioxide emissions into the atmosphere are primary smelters and fossil fuel combustion (such as coal-fired power plants). The primary sources of nitrogen oxides are high temperature combustion processes largely from fossil fuel power plants and mobile sources such as trucks and automobiles.

4. Acidic deposition takes the form of (1) wet deposition (acidic rains, snows, sleets, hail, or fog) and (2) dry deposition in which pollutants in dry form fall to earth awaiting some future precipitation or other moisture to transform them into the same acids formed in wet deposition.

5. Acid deposition has the potential to damage aquatic ecosystems, soils, vegetation, man-made objects, and human health.

Much less is known about the complex transport and transformation processes to assess the extent to which emission sources in one location lead to acid deposition in another. There is uncertainity about the proportion and relative importance of wet versus dry deposition.

Gibson and Linhurst (1982) indicate that much of the eastern and northeastern U.S. and eastern Canada is receiving acid precipitation at pH levels less than 4.7. Acidity decreases as one moves in a westerly direction; the lowest acidities are encountered in the midwestern and Rocky Mountain states. As one continues to move west acidity again increases with peak values encountered around major industrial and metropolitan areas. Demonstrated effects to date appear to be primarily those in aquatic systems.

Research on potential effects to plants and soils is as yet inconclusive.

Because the applicants' proposed projects would be additional sources of emissions of sulfur dioxide and nitrogen oxides to the atmosphere, an analysis of potential acid deposition that might result from the facilities and associated activities was performed by Systems Applications Inc. (1982). It should be recognized that a number of simplifying assumptions are involved and that the results should be considered a first approximation.

For the high-level scenario, dry deposition in the area of influence was estimated from annual average concentration isopleth maps. Figures R-4-2 and R-4-3 summarize the dry deposition calculations. Since these plots were derived from the GPM model calculations, they are expected to be conservative. Wet deposition was estimated from the precipitation data for Grand Junction and the surrounding region and determined to be approximately equal to dry deposition (see Appendix R-G)

The rates of dry and wet deposition thus determined can be placed in perspective by comparing values with those observed in the United States and Europe, as indicated in Table R-4-14. For example, in the middle of the projected development areas in the Uintah and Piceance basins and in the populated and industrialized area near Grand Junction both sulfur and nitrogen oxides depositions are expected to be greater than 1 gram per square meter per year ($g/m^2/yr$) by dry deposition. This is greater than rates measured currently in Oak Ridge, Tennessee, and northern California (Table R-4-14). However, dry deposition in wilderness areas such as Flat Tops and Mount Zirkel and in Dinosaur National Monument is calculated to be about 0.1 $ug/m^2/yr$), which is similar to rates measured at the above mentioned locations. If wet deposition rates are comparable to dry rates, wet deposition in the midst of the developed regions would be comparable to those measured currently in the eastern U.S. and in Europe, but wet deposition in wilderness areas would be at background values.

The significance of the predicted deposition levels related to environmental impacts is difficult to assess, because so little is presently known regarding effects of acid deposition on ecosystems. One would expect, for reasons stated in Appendix R-G concerning the sensitivity of the potentially affected ecosystems, that predicted increased deposition levels in the lower elevation areas, even to levels equaling the eastern U.S., would not lead to significant adverse impacts. Higher elevation areas in the region are expected to be the more sensitive ecosystems. In Flat Tops Wilderness Area, it was estimated that sulfur and nitrogen deposition would be as high as 0.2 and 0.4 $ug/m^2/yr$, with approximately equal contributions due to wet and dry deposition. Turk and Adams (1982) have measured the buffering capacity of a number of lakes in Flat Tops. Using their data for a well-buffered lake (Lower Marvine Lake) and a poorly buffered lake (Ned Wilson Lake), minimum lake pH values of 8.0 and 6.0, respectively, were calculated which represents small changes in acidity for those two lakes. It is not currently known what effect, if any, these small shifts in lake pH would have on biota.

Air Quality Impacts Associated with Construction Activities

Although it is difficult at this time to quantify construction impacts, they are expected to be small compared to the longer term impacts associated with the operation of synfuel facilities. The air quality impacts associated with construction activities would be temporary and intermittant in nature. Impacts would include fugitive dust emissions resulting from the use of large earth-moving equipment and small quantities of emissions from the exhaust of such equipment. Impacts resulting from population growth associated with construction activities would be proportional to such population growth and

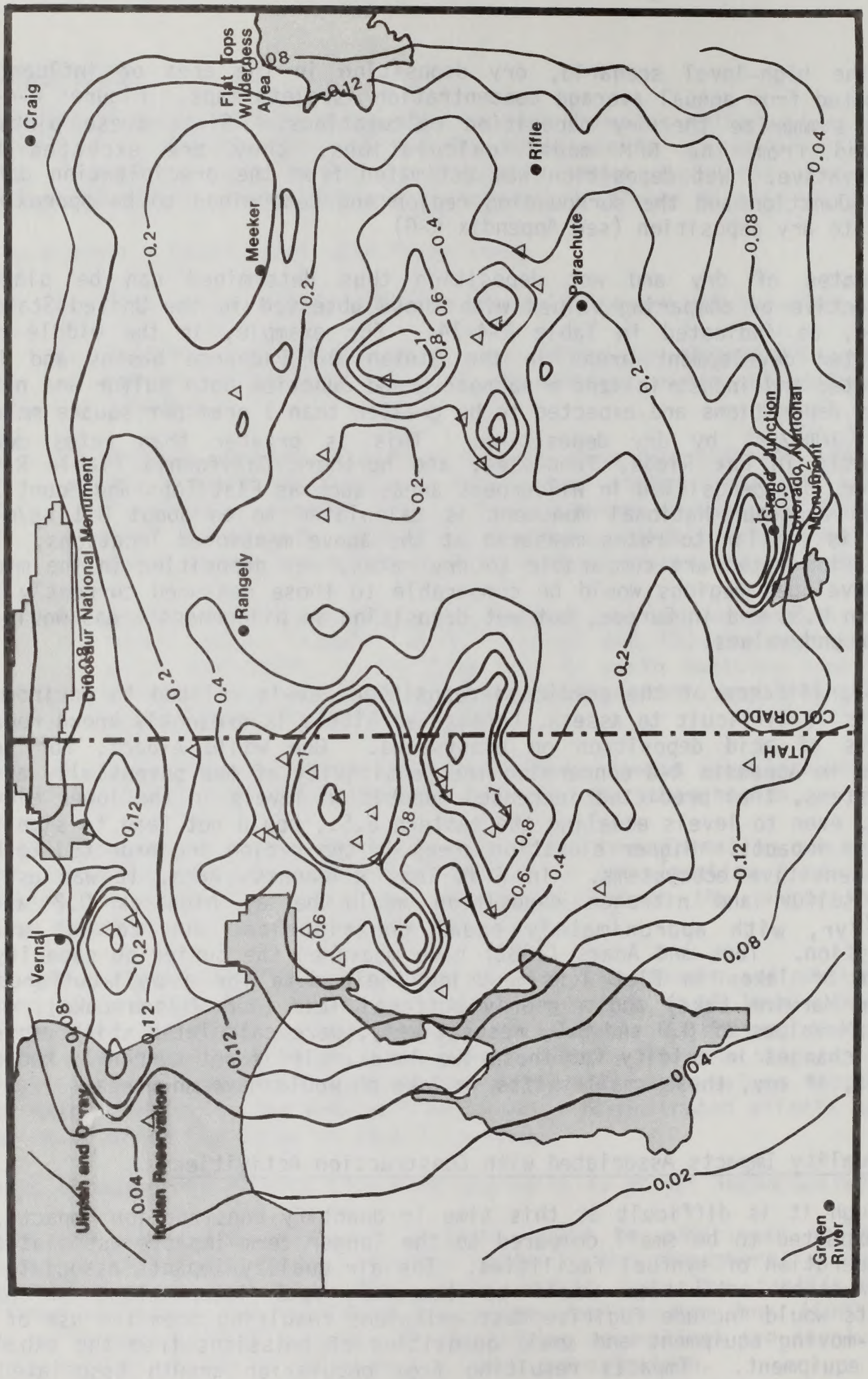


FIGURE R-4-2 ANNUAL SULFUR ANION DRY DEPOSITION (g/m²/yr)

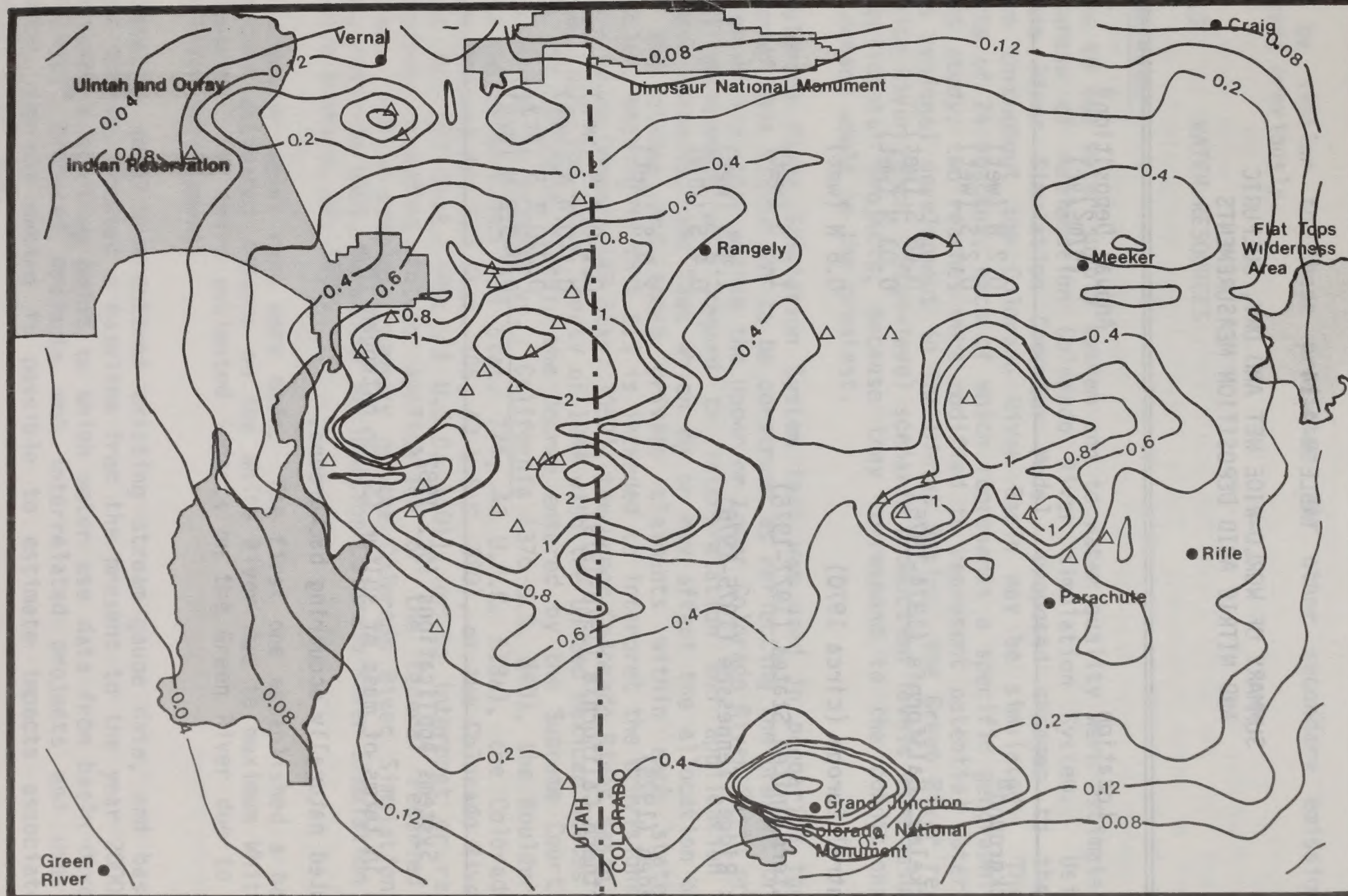


FIGURE R-4-3 ANNUAL NITROGEN ANION DRY DEPOSITION ($g/m^2/yr$)

TABLE R-4-14

SUMMARY OF WORLD-WIDE WET AND DRY, SULFURIC AND NITRIC ACID DEPOSITION MEASUREMENTS

Location	Annual Deposition[a] ($g/m^2/yr$)
Background[b]	0.2 N (wet) 0.2 S (wet)
Berkeley, California (1974-1975)	0.48 S (wet) 0.03 N (wet)
Central Europe (circa 1970)	0.6 N (wet)
Eastern United States (1977-1978)	1.2 S (wet)
Oak Ridge, Tennessee (1975-1976)	1.4 S (wet) 0.4 S (dry)
Sweden (1975)	2.5 S (wet)
Northern California (1978-1979)	0.1-0.3 S (wet) 0.1-0.4 N (wet) 0.0-0.1 S (dry) 0.0-0.2 N (dry)

Source: Systems Applications Inc. 1982.

[a]Stated in terms of mass of sulfur (S) or nitrogen (N).

[b]Estimated naturally occurring background.

would be similar to those predicted for other secondary emissions, as discussed previously.

R-4.A.3 WATER RESOURCES

Surface Water

Changes to the water supply system and to water quality were estimated using the Bureau of Reclamation Colorado River Simulation System. Using the Colorado River Simulation Computer Model, proposed changes to the water balance throughout the Colorado River Basin may be simulated. The model consists of 24 reaches, each of which represents a specific geographic area. In this study, two reaches were modified to represent potential water demand due to regional development in the Uintah Basin: the Green River reach and the White River reach. High-level scenario production levels were assumed for all applicants' projects, because they correspond to the conditions where water demand would be the greatest.

The Colorado River Simulation System that was used in preparing the water section of this EIS is not to be construed as reflecting the present or future position of any state within the Upper or Lower Colorado River Basin or of the federal government with regard to interpretation and application of the treaties, compacts, and laws which do or may affect the allocation of water among the states and among private claimants within each state. In particular, nothing in this EIS is intended to interpret the provisions of the Colorado River Compact (45 Stat. 1057), the Upper Colorado River Basin Compact (63 Stat. 31), the Water Treaty of 1944 with the United Mexican States (Treaty Series 994, 59 Stat. 1219), the decree entered by the Supreme Court of the United States in Arizona vs. California (376 U.S. 340), the Boulder Canyon Project Adjustment Act (54 Stat. 774; 43 U.S.C. 618a), the Colorado River Storage Project Act (70 Stat. 105; 43 U.S.C. 620), or the Colorado River Basin Project Act (82 Stat. 885; 43 U.S.C. 1501), or to interpret or reach any conclusions regarding future application of the federal reserved rights doctrine. For a complete summary of the Colorado River Simulation System series, refer to USDI, Bureau of Reclamation Colorado River Simulation System-Executive Summary, 10, 1981.

Three computer model runs were made. The first one established a baseline. The second estimated impacts on the White River due to maximum White River development. The third estimated impacts on the Green River due to maximum Green River development.

The baseline model run entered existing stream gauge data, and based upon current trends, created a baseline from the present to the year 2000. This established a starting point to which water use data from basin development (applicants' proposed projects and interrelated projects and uses) could be added, thereby making it possible to estimate impacts associated with increased water use.

Maximum White River Development

The input for this model run assumed that all projects in the Uintah Basin that specified the White River as a proposed or alternative water source would use it and that the White River Dam would function as designed by the Utah Department of Water Resources. Table R-4-15 lists the projects and water requirements considered in this case. In addition to these projects, there is a large amount of water that is included in the baseline use. This amount of water is based on current and projected increases in water use, the largest of which is 80,000 ac-ft/yr for the Uintah and Ouray Indian Reservation, which is assumed to be withdrawn by 1990. Considering baseline water use, and the water that would be used by the applicants' proposed projects, and by interrelated projects and uses, projections can be made about depletions, flow, and salinity. Current depletions on the White River are 37,000 ac-ft/yr. This baseline amount would increase to 166,000 ac-ft/yr by 2,000. Water use for the applicants' proposed projects and interrelated projects and uses would have similar increases in depletions as shown on Table R-4-16 and Figure R-4-4.

Due to these depletions, flow would change. Table R-4-16 shows projected baseline flows on the White River as measured at the confluence with the Green River. They are computer generated values based upon past hydrological records. Table R-4-17 also shows the resulting flows due to water depletions by the applicants' proposed projects and interrelated projects. Figure R-4-5 graphically shows the percent reduction in flow over the baseline flow.

The previously cited depletions and resulting changes in flow would cause salinity to increase as shown in Table R-4-18. Figure R-4-6 graphically shows increases in salinity that would be due to the applicants' proposed projects and the cumulative effects of the applicant's projects plus interrelated projects. The large peak that is shown in this graph is due to a year of low flow and large depletions. It is important to note that such increases in salinity are possible; however, a more meaningful measure of changes in salinity would be an average. On the White River, the average increase in salinity due to the applicants' proposed projects and interrelated projects for the years 1985 to 2000 would be 12 mg/l. Although actual values were not calculated for the applicants' proposed projects, they are estimated (based upon relative amounts of water use) to be responsible for approximately a 4 mg/l increase.

Maximum Green River Development

This model run considered maximum development on the Green River. The input for this model run assumed that all projects in the Uintah Basin that specified the Green River as a proposed or alternative water source would use it. Table R-4-15 lists the projects and water requirements considered in this case.

TABLE R-4-15

WATER REQUIREMENTS USED IN MODELING (ac-ft/yr)[a]
High-level Scenario

Project	Maximum White River Development	Maximum Green River Development	Total Water Use Regardless of Sources[b]
UBS APPLICANTS			
Enercor (Rainbow)	5,000	5,000	5,000
Enercor-Mono Power (P.R. Springs)[c]	12,000	12,000	12,000
Geokinetics	NA	1,000 (1,350)	1,000 (1,350)
Magic Circle[d]	1,000 (540)	1,000 (540)	1,000 (540)
Paraho	3,000 (2,900)	NA	3,000 (2,900)
Sohio	NA	4,000 (3,620)	4,000 (3,620)
Syntana-Utah	7,000	NA	7,000
Tosco	9,000	9,000	9,000
Subtotal	37,000	32,000	42,000
INTERRELATED PROJECTS			
Bonanza Power Plant	NA	22,000 (21,700)	22,000 (21,700)
White River Shale	28,000 (27,100)	28,000 (27,100)	28,000 (27,100)
Municipal/Industrial Use[e]	20,000	20,000	20,000
Agriculture[f]	20,000	20,000	20,000
Subtotal	68,000	90,000	90,000
TOTAL	105,000	122,000	132,000

NA=Not Applicable

[a]Water requirements were rounded to the nearest thousand; where these were not the actual water requirement, they are shown in parentheses.

[b]Figures do not total horizontally on table because the White River and Green River are alternative sources for several of the projects.

[c]Information for this project was not included in the White River Dam Final EIS (BLM 1982b).

[d]Alluvial wells specified (by the applicant) as water sources were treated and modeled as surface waters.

[e]Estimated increases of water use from projected population increases in the work force and from other industrial increases.

[f]Estimated requirement based upon agricultural trends.

TABLE R-4-16

CHANGES IN FLOW (ac-ft X 1,000)
High-level Scenario

	MAXIMUM WHITE RIVER DEVELOPMENT			MAXIMUM GREEN RIVER DEVELOPMENT			COMMON TO BOTH CASES					
	White River at Confluence with Green River			Green River at Confluence with Colorado River			Inflow to Lake Powell			Imperial Dam		
	Baseline	Baseline Plus Applicants' Projects	Baseline, Applicants, Interrelated Projects	Baseline	Baseline Plus Applicants' Projects	Baseline, Applicants, Interrelated Projects	Baseline	Baseline Plus Applicants' Projects	Baseline, Applicants, Interrelated Projects	Baseline	Baseline Plus Applicants' Projects	Baseline, Applicants, Interrelated Projects
1983	693	690	684	6,540	6,537	6,525	16,817	16,812	116,801	9,649	No Reduction in Flow[a]	
1985	332	320	285	2,341	2,328	2,293	5,898	5,881	5,829	5,655	No Reduction in Flow[a]	
1990	296	270	241	2,287	2,264	2,213	6,444	6,413	6,362	5,647	No Reduction in Flow[a]	
1995	294	257	207	4,283	4,251	4,179	7,759	7,717	7,649	5,640	No Reduction in Flow[a]	
2000	355	318	250	3,978	3,946	3,865	10,248	10,205	10,116	5,613	No Reduction in Flow[a]	

[a]No reductions in flow were predicted for any of the analysis years (1983-2000).
All obligated flows were met and any excess water stored in the Colorado River System.

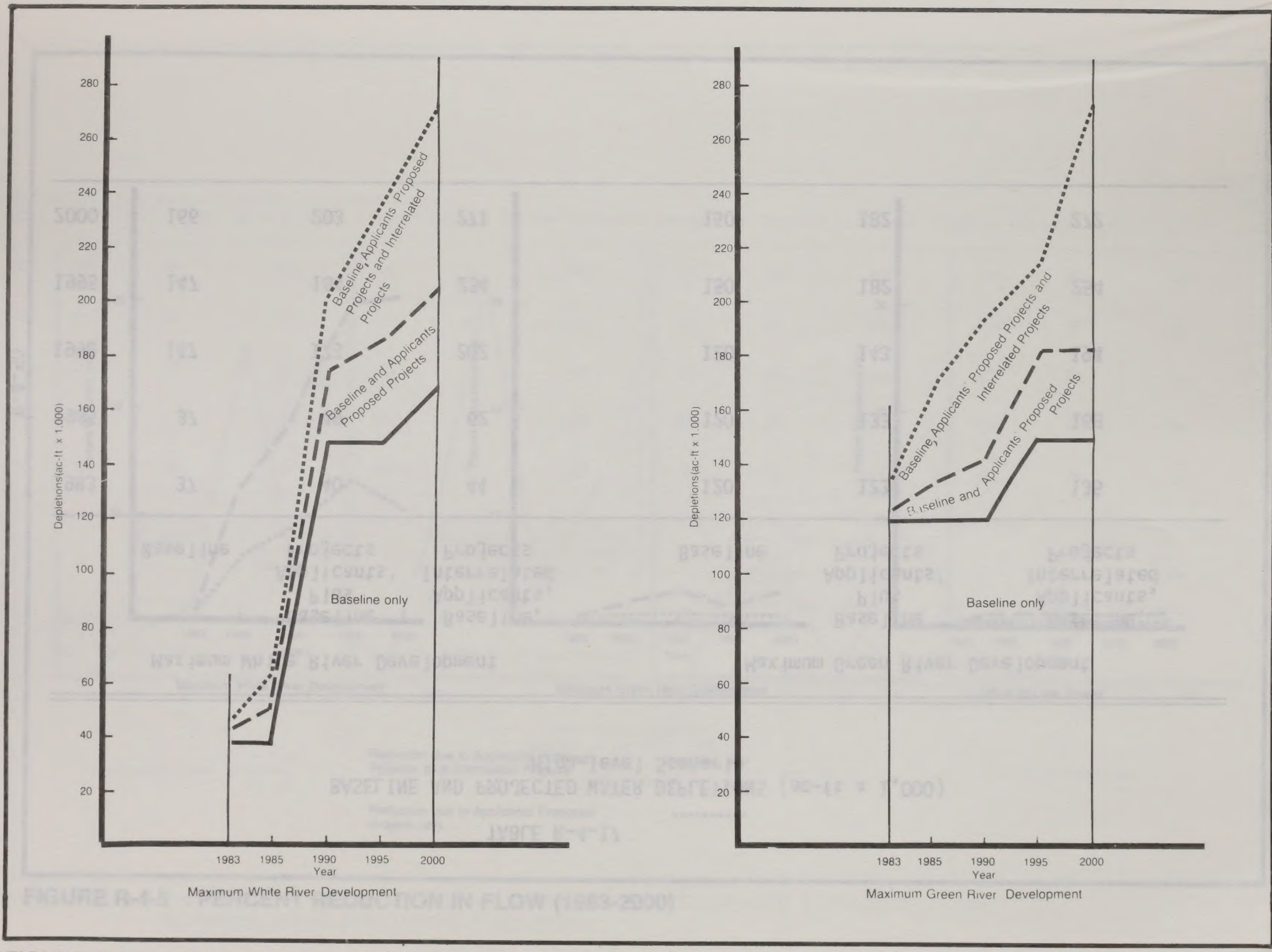


FIGURE R-4-4 BASELINE AND PROJECTED WATER DEPLETIONS (1983-2000)

TABLE R-4-17

BASELINE AND PROJECTED WATER DEPLETIONS (ac-ft x 1,000)
High-level Scenario

	Maximum White River Development			Maximum Green River Development		
	Baseline	Baseline Plus Applicants' Projects	Baseline, Applicants, Interrelated Projects	Baseline	Baseline Plus Applicants' Projects	Baseline, Applicants, Interrelated Projects
1983	37	40	44	120	123	135
1985	37	49	62	120	133	168
1990	147	173	202	120	143	194
1995	147	184	234	150	182	254
2000	166	203	271	150	182	272

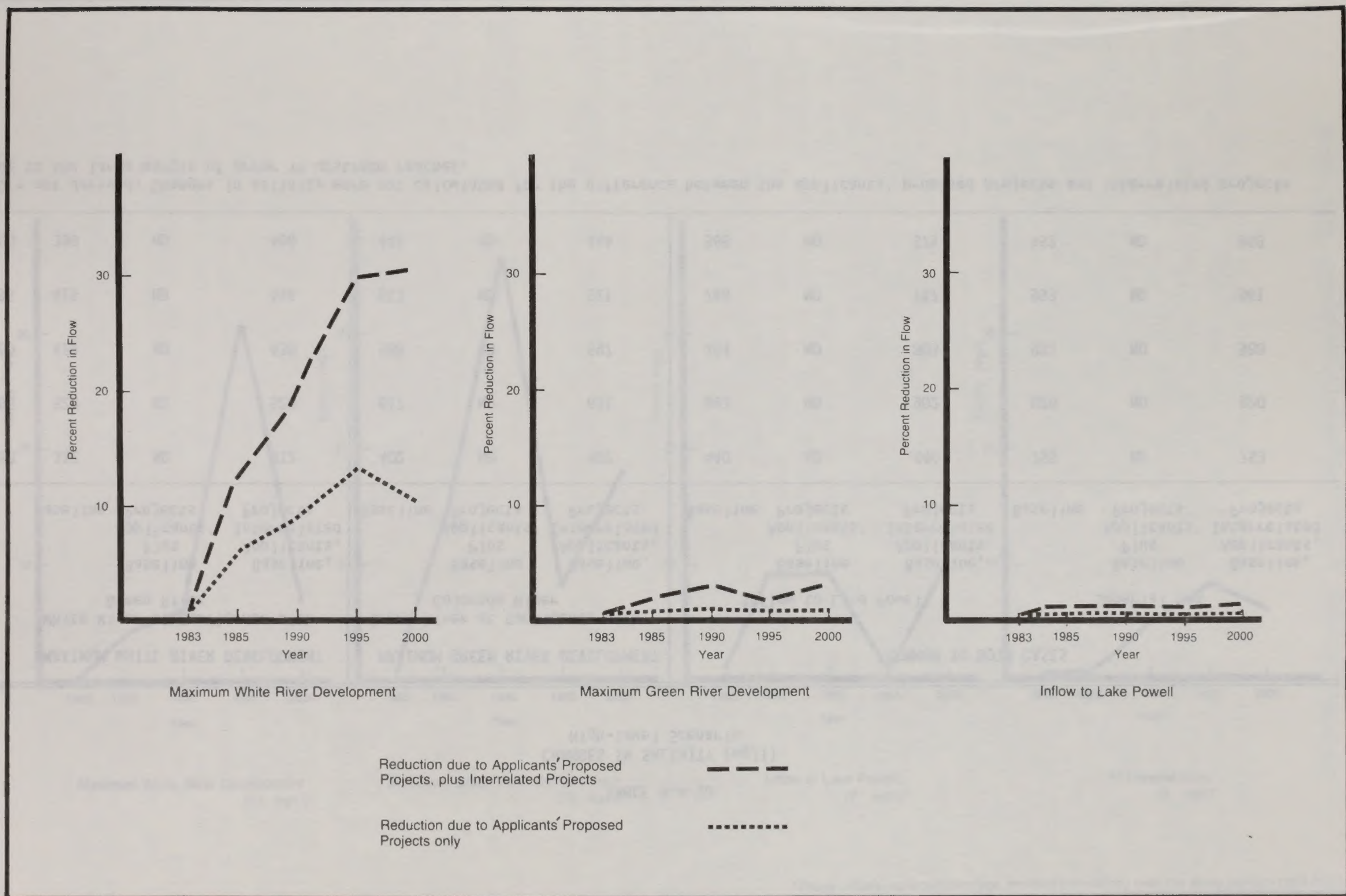


FIGURE R-4-5 PERCENT REDUCTION IN FLOW (1983-2000)

TABLE R-4-18

CHANGES IN SALINITY (mg/l)
High-level Scenario

	MAXIMUM WHITE RIVER DEVELOPMENT			MAXIMUM GREEN RIVER DEVELOPMENT			COMMON TO BOTH CASES					
	White River at Confluence with Green River			Green River at Confluence with Colorado River			Inflow to Lake Powell			Imperial Dam		
	Baseline	Baseline Plus Applicants' Projects	Baseline, Applicants, Interrelated Projects	Baseline	Baseline Plus Applicants' Projects	Baseline, Applicants, Interrelated Projects	Baseline	Baseline Plus Applicants' Projects	Baseline, Applicants, Interrelated Projects	Baseline	Baseline Plus Applicants' Projects	Baseline, Applicants, Interrelated Projects
1983	312	ND	312	402	ND	402	440	ND	440	755	ND	753
1985	522	ND	526	617	ND	631	893	ND	902	820	ND	820
1990	424	ND	430	560	ND	597	794	ND	803	983	ND	988
1995	415	ND	446	513	ND	521	746	ND	747	953	ND	961
2000	399	ND	406	446	ND	464	565	ND	575	952	ND	958

[a]ND = not derived. Changes in salinity were not calculated for the difference between the applicants' proposed projects and interrelated projects due to the large margin of error in upstream reaches.

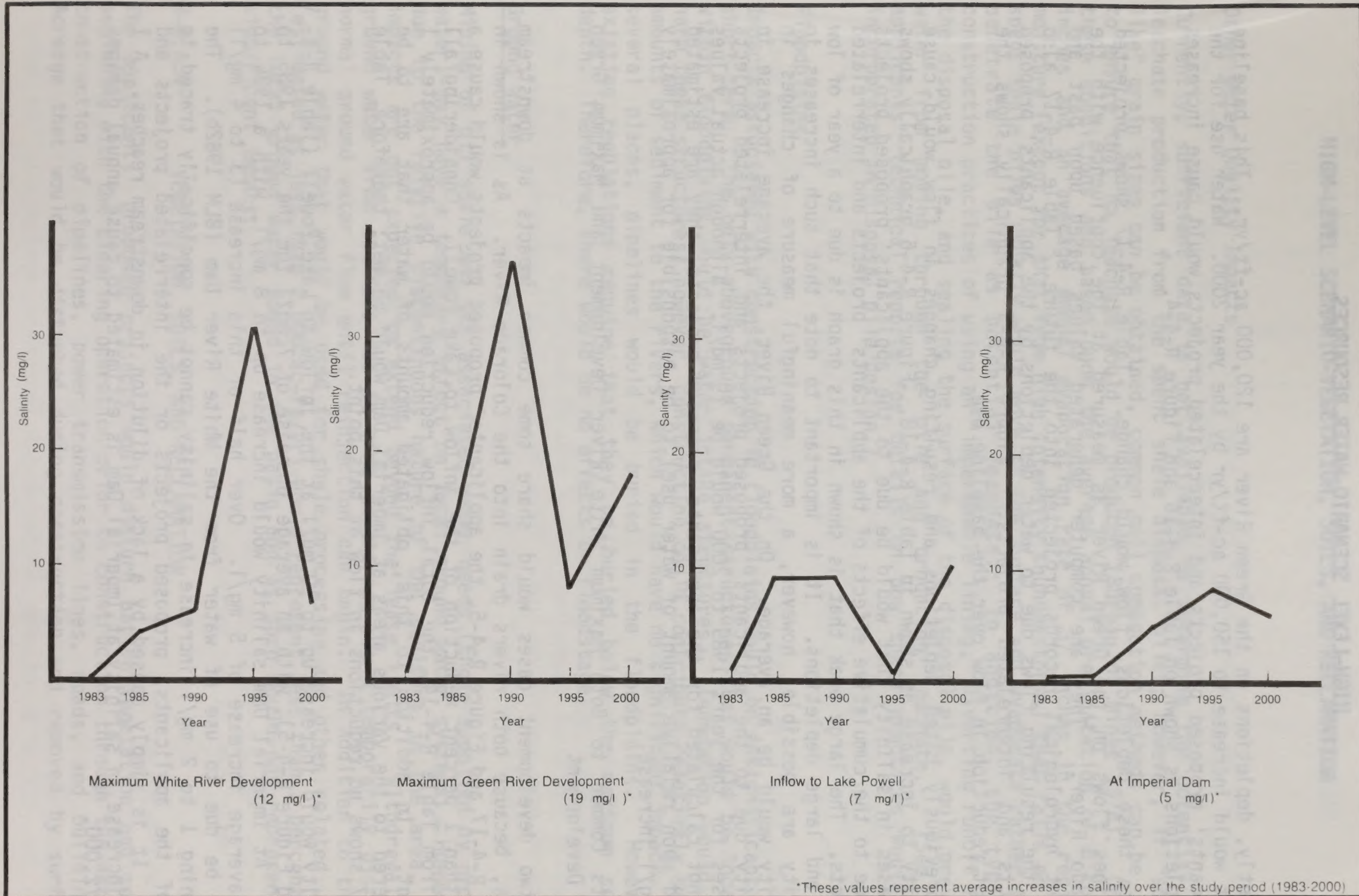


FIGURE R-4-6 CHANGES IN SALINITY DUE TO APPLICANTS' PROPOSED PROJECTS PLUS INTERRELATED PROJECTS (1983-2000)

Currently, depletions on the Green River are 120,000 ac-ft/yr. This baseline amount would increase to 150,000 ac-ft/yr by the year 2000. Water use for the applicants' proposed projects and interrelated projects would cause increases in depletions as shown on Table R-4-16 and Figure R-4-4.

Due to these depletions, flow would change. Table R-4-17 shows projected baselines flows on the Green River as measured at the confluence with the Colorado River. They are computer generated values based upon past and present hydrological records projected into the future. Table R-4-17 also shows the resulting flows due to water depletions by the applicants' proposed projects and interrelated projects. Figure R-4-5 graphically shows the percent reduction in flow over the baseline use.

The previously cited depletions and resulting changes in flow would cause salinity to increase as shown in Table R-4-18. Figure R-4-6 graphically shows increases in salinity that would be due to the applicants' proposed projects and due to the cumulative effects of the applicants' projects and interrelated projects. The large peak that is shown in this graph is due to a year of low flow and large depletions. It is important to note that such increases in salinity are possible; however, a more meaningful measure of changes in salinity would be an average. On the Green River, the average increase in salinity due to the applicants' proposed projects and interrelated projects and uses for the years 1985 to 2000 would be 19 mg/l. Although actual values were not calculated for the applicants' proposed projects, they are estimated (based upon relative amount of water use) to be responsible for approximately a 4 mg/l increase.

Impacts Common to Both Maximum White River Development and Maximum Green River Development

The two development cases would share some common impacts at downstream points, because both rivers drain into the Colorado River. As is shown in Table R-4-17 and Figure R-4-5, the applicants' proposed projects would cause a less than 1 percent reduction of the inflow to Lake Powell. Considering all uses from Table R-4-14, the total inflow reduction would be approximately 1 percent. In addition to this, obligated amounts of water that are to be delivered to the various areas at Imperial Dam would be met; therefore, Table R-4-17 shows no reductions in flow at this point.

Salinity would increase up to 10 mg/l at the inflow to Lake Powell (Table R-4-17 and Figure R-4-5), with an average increase of 7 mg/l for the years 1985 to 2000. At Imperial Dam salinity would increase up to 8 mg/l, with a 1985 to 2000 average increase of 5 mg/l. Over half of this increase (3 to 4 mg/l) would be due to use of water from the White River Dam (BLM 1982b). The remaining 1 to 2 mg/l increase in salinity cannot be specifically traced to any of the applicants, proposed projects or the interrelated projects and uses. It is simply caused by a lack of dilution in downstream reaches. A 1 mg/l increase in salinity at Imperial Dam is estimated to cause annual damages of $472,000.

Other Water Quality Impacts

Currently, sufficient data is not available to determine the potential for leachate production from the spent shale disposal piles; however, if "soil-like" grain sizes can be obtained, common soil compaction methods can be used to ensure that no leachate would be produced (Bureau of Mines 1976). Under these conditions and based upon the average annual precipitation of 8 to 10 inches and an average annual evaporation rate of 37 inches in the region, moisture (except for that from high intensity thunderstorms) that falls on the spent shale piles usually would move to the surface and evaporate rather than penetrate the pile as potential leachate. In addition, the typical construction practices of using an "impermeable lining," diverting runoff from the disposal pile, and sealing the surface of the disposal pile, would prevent water from moving through the pile and producing leachate. (See the applicants' technical reports for details on how these practices would be incorporated in disposal pile design.)

Floodplains

Impacts associated with construction in floodplains would be insignificant and short-term. The only aboveground permanent structures that would be located within floodplains would be water intake structures. Inundation would not harm these structures; however, construction could contribute relatively small amounts of sediment to the rivers, which would have no significant impact. In several places, pipelines would be buried in the floodplains. However, existing regulations require that they be buried below the maximum scour depth. Therefore, there would be no effects on floodstage.

<u>Ground Water</u>

Mining of oil shale and its associated water needs (those supplied by ground water) may have a temporary effect on local ground water systems. However, due to the relative discontinuous nature of the aquifers in the area, the impacts are not expected to extend beyond the lease limits. Withdrawal of ground water from aquifers due to mine dewatering would temporarily disrupt normal ground water flow until reinjection can begin. In addition to this, ground water that would be used for shale processing and other related uses (estimated at less than 2,000 ac-ft/yr) would represent less than 1 percent of the total ground water found in the basin and as such would not represent a significant impact.

R-4.A.4 VEGETATION, SOILS, AND RECLAMATION

The applicants' proposed projects would disturb native vegetation and soils beginning with the clearing operation prior to construction through the actual construction of pipelines, power transmission lines, roads, and buildings. Acreage that would be disturbed during construction and removed by surface

facilities of the proposed projects is summarized in Table R-1-7 (Section R-1.B). The majority of the disturbance would occur by the year 1985, with surface mining and spent shale disposal continuing beyond the peak operation year of 1995.

Vegetation

Construction of the applicants' proposed projects would disturb 36,911 acres of vegetation; a total of 52,631 acres would be disturbed by the applicants' proposed projects plus the interrelated projects. Table R-4-19 identifies the acres of each vegetation type within the area of influence that would be disturbed.

Right-of-way clearing for construction of pipelines, power transmission lines, road ditches, and disturbance near building sites from the applicants' proposed projects and interrelated projects in the region would remove vegetation and cause a short-term loss of vegetative production.

Permanent structures associated with the applicants' proposed projects would occupy 7,339 acres. Components of the interrelated projects, such as buildings, road surfaces, plant facilities, power transmission line towers, and pumping stations, would occupy 3,971 acres. Upon abandonment of each project, the structures would be removed and the site reclaimed through practices described in Appendix R-J.

Loss of vegetation due to the applicants' projects and interrelated projects is summarized by type in Table R-4-19. This loss represents less than 2 percent of the total vegetation of the area of influence and less than 1 to 2 percent of each vegetation type. Refer to Table R-3-10 (Section R-3-A.4) for vegetation types potentially affected by project components.

Approximately 1 percent would be considered a temporary loss from clearing of rights-of-way and 1 percent would be a long-term loss from occupancy by surface structures and mines.

Climatic conditions in the area of influence make establishment of vegetative cover difficult. Should conditions be unfavorable at the time of seeding or planting, survival of seedlings could be expected to be low, which would allow noxious weeds to invade and leave other areas bare. Attention to erosion control measures would be critical. Under existing conditions, the results of vegetation removal would be significant, as favorable years for seedling establishment can be as variable as once every 20 years (Moore and Rudd 1981).

Loss of vegetation from construction and spent shale disposal piles would be temporary, since reclamation and revegetation practices would be intensively initiated within 1 year after disturbance; however, vegetation would not be available to livestock due to continued work in the disposal area. Structures, road beds, and parking areas would result in a loss of vegetative cover for the life of the projects but would be revegetated following

TABLE R-4-19

REGIONAL VEGETATION TYPES AND DISTURBANCE
High-level Scenario

		DISTURBANCE			
Vegetation Type	Acres in Area of Influence	By Applicants' Projects (Acres)	By Applicants' Projects (% of Type)	By Applicants Plus Interrelated Projects (Acres)	By Applicants Plus Interrelated Projects (% of Type)
Riparian	6,150	100	1.6	100	1.6[a]
Mixed-Desert shrub	1,843,200	19,356	1.0	32,688	1.7
Pinyon-juniper	483,840	11,232	2.2	11,624	2.2
Upland-brush	322,560	2,621	0.8	4,737	1.4
Sage-grass	161,280	3,355	2.0	3,355	2.0
Bookcliffs woodland	230,400	247	0.1	247	0.1
TOTAL	3,047,430	36,911	1.2	52,631	1.7

NA = Not Applicable

[a]Acres of riparian vegetation disturbed by interrelated projects in unknown.

abandonment of the projects. (See the Soils and Reclamation section below.) Success of vegetation recovery would depend upon climatic conditions and site-specific practices.

Removal of wood products such as fuel wood and posts from pinyon and juniper trees would amount to approximately 90,000 cords of wood (Smith 1981). This represents less than 2 percent of the estimated 5,800,000 cords of wood available in the region. Loss of fuel wood is not significant at this time but could become a significant resource loss as the population of the region increases and the trend toward using pinyon and juniper trees as a fuel source also increases toward the end of the study period.

The wood products would not be lost to utilization, because construction permits generally provide for utilization of the trees by local residents. However, in most cases, production regrowth would be delayed for the life of the project at plant sites and for 3 to 10 years on linear rights-of-way. Roads retained in the county transportation system would result in a permanent loss.

Threatened and Endangered Plants

One hookless cactus plant (Sclerocactus glaucus), federally listed as threatened (Federal Register 1980b), has been located within the proposed Magic Circle spent shale disposal area. Bio-Resources Inc. (1982) has determined the plant would be covered by the disposal pile. BLM has initiated consultation procedures with the Fish and Wildlife Service concerning conservation measures for protection of the plant. No other federally or state-listed threatened or endangered plant species are known to be threatened by construction in the area of influence. However, secondary impacts from trampling, crushing, or collecting by recreationists could affect other species listed as candidate or locally sensitive species identified by the BLM Vernal District Office (1981g) and the Uintah and Ouray Indian Reservation headquarters in Fort Duchesne (Mutz 1980).

Soils and Reclamation

Erosion control, reclamation, and revegetation of land disturbance caused by project construction and operation is expected to be successful assuming (1) implementation of the erosion control and reclamation programs outlined by the applicants; (2) compliance with site-specific erosion control and reclamation plan approved by authorizing agencies (federal and state), private landowners and the Ute Indian Tribe; and (3) compliance with the accompanying requirements and stipulations that are a part of the right-of-way grants and mineral leases for federal and state lands. It is assumed that effective erosion control and reclamation procedures would be implemented on all lands (BLM, Indian owned and controlled, state and private lands) to assure a consistent, complete and successful reclamation program throughout the project area. However, the application and compliance with these procedures would be at the discretion of the authorizing agencies and landowners.

Refer to Appendix R-J for a detailed discussion regarding evaluations of applicants' erosion control and reclamation programs, Erosion Control, Reclamation and Revegetation Guidelines for use on federal lands, and State of Utah reclamation requirements as outlined by Form MR-1 (revised May 1982).

Impacts to soils would be generally insignificant, because soil loss and the reduction of its productive capacity is expected to be minimized with implementation of effective erosion control and reclamation procedures. Some unquantifiable soil loss resulting from accelerated wind and water erosion would occur until erosion control measures are implemented. However, soil impacts would be significant if applicable erosion control measures are not implemented due to lack of compliance with approved plans and if adverse weather conditions (mainly heavy rainstorms) would occur during construction before erosion control measures could be installed. A few, small, unquantifiable areas (mainly abrupt steep slopes and areas of soils with very unfavorable physical and chemical properties) would be subject to accelerated erosion and require intensive and continuing follow-up erosion control measures.

Successful revegetation of project-related disturbance would not be possible without wind and water erosion control measures to reduce surface wind velocities and control surface water runoff to maintain favorable soil characteristics while establishing a vegetation cover. Implementation of the applicants' proposed reclamation programs would minimize erosion and replace understory vegetation to near preconstruction densities within 3 to 10 years following construction. Brush species of the sage-grass type would recover within 10 to 20 years following initial establishment. Trees of the riparian types would require up to 75 years to attain preconstruction height, while juniper and conifer trees of the pinyon-juniper and Bookcliffs woodland would require from 100 to 300 years.

Several different kinds of land disturbance caused by project activities would occur throughout the area of influence. These include: (1) land disturbed by installation and construction of right-of-way facilities, such as pipelines, roads and power transmission lines; (2) disturbance associated with spent shale disposal; (3) disturbance due to surface mining; (4) disturbance caused by "in situ" retorting processes; and (5) plant site facility disturbance.

Rights-of-Way Disturbance

Construction of the applicants' proposed right-of-way facilities would temporarily disturb 4,355 acres of soils for approximately 1 to 2 years (Table R-1-7, Section R-1.B). When the cumulative effects of the interrelated projects are also considered, 6,471 acres would be disturbed in the area of influence. Construction and installation of right-of-way facilities (pipelines, roads and power transmission lines) would cause topsoil disturbance, soil compaction and alteration of the soil profile along the excavated trench area of pipelines and along borrow areas of roads. Accelerated wind and water erosion would occur until erosion control measures are implemented (1 year). Also, right-of-way facilities requiring access

roads for maintenance would create problems in controlling ORV traffic and minimizing off-road land disturbance.

Several of the right-of-way areas are proposed to be utilized as common facility corridors for more than one applicant and would contain more than one facility. These areas would be disturbed during several different periods, which would not allow time for complete preconstruction revegetation recovery. Therefore, reliance on effective erosion control measures, such as crop residue mulches, surface roughness, use of rock fragments on the surface and slope length reduction measures would be essential to control wind and water erosion. These areas would be subject to the invasion of invader plants, mainly halogeton, until seeded species become established.

Spent Shale Disposal Areas

Regional disturbance associated with the spent shale disposal areas would occur on 10,620 acres of state and private land, of which 7,670 acres would be disturbed by the applicants' proposed projects. (Spent sand would be returned to mined areas, so no additional surface disturbance would result from its disposal.)

Vegetation cover and topsoil, including soil material favorable for plant growth because the topsoil layers are thin, would be removed from the area where the spent shale is to be placed. These materials would be stockpiled in stages concurrent with project operations and used later for reclamation purposes. The total area would not be disturbed or covered by spent shale in the early stages of a project; however, the shale placement process and associated traffic would necessitate exclusion of other uses such as livestock grazing from most of the area for the life of the projects.

The spent shale disposal areas would be reclaimed in stages concurrent with project operations and continue throughout the life of the projects. The surface of these areas would be stabilized and made suitable for plant growth through various reclamation measures and procedures. Spent shale can be used as a plant growth medium if the salt content and the pH in the root zone is reduced to a tolerable level (Cook 1974). However, covering the spent shale with topsoil and soil materials suitable for plant growth would minimize the problems of making the spent shale favorable for revegetation. To ensure an effective thickness for plant growth, a mantle of at least 12 to 18 inches of suitable plant growth material would be necessary (Cook 1974). The applicants' reclamation programs have been evaluated (Appendix R-J), and each program identifies applicable reclamation measures and procedures that, if properly implemented, would make the surface suitable for plant growth, control surface runoff and erosion, and minimize the visual impact.

The volumes of soil materials needed to cover the proposed spent shale piles would be large, creating concerns of availability, costs placement, and maintenance. The approximate volume of soil material that would be required for each site-specific project is identified in the Chapter 4, Vegetation, Soils, and Reclamation section of each site-specific project discussion. Since soils in the area are dominantly shallow to moderately deep, detailed

soil surveys and on-site investigation would be necessary to identify areas of favorable soil materials within the disposal area.

Surface Mining Disturbance

Regional surface mining activities would disturb a total of 10,050 acres of state and private land, of which 6,490 acres would be disturbed by the proposed Sohio and Enercor-Mono Power tar sand strip mine projects. The disturbance would occur at a rate of 524 to 900 acres per year. This would affect soils by altering existing soil characteristics and properties, changing topography and exposing unsuitable plant growth materials, which could affect soil productivity. Accelerated wind and water erosion would occur until disturbed areas are reshaped and erosion control measures are implemented (1 to 2 years). During this period soil losses would be controlled to be within the recommended limits of construction conditions (10 to 15 tons per acre per year for the first year and 5 tons per acre per year for any succeeding year; Harder 1978). The exception to this would be if adverse weather conditions (mainly heavy rainstorms) would occur before any erosion control measures could be implemented, causing surface soil and soil plant growth material loss to the extent that reshaping and replacement of favorable surface soil materials would be required to provide suitable conditions for revegetation. Surface runoff control structures would control sediment and protect surface water quality. Reclamation would be accomplished in stages concurrent with project mining operations. Surface reshaping, topsoil replacement, and erosion control measures would be initiated as the mine areas are backfilled. Revegetation procedures would then be implemented as seasonal conditions permit.

In-situ Retorting Process Disturbance

Cumulatively, all the projects planned for the Uintah Basin that would use an in-situ retorting process would disturb 7,640 acres of state and private land, of which 7,000 acres, at scattered locations, would be disturbed by the Geokinetics Lofreco Project. This disturbance would occur concurrently with project operations, with approximately 300 to 3,520 acres disturbed at a time. The surface disturbance would consist of vegetation removal and topsoil disturbance in plot-like areas ranging in size from 2.5 acres to 10 acres. Also, the controlled underground blasting that would be required would cause surface heaving and fracturing. Heat resulting from the in-situ retort process could raise soil temperatures in the vegetation root zones. This could affect the soil-moisture relationship, because the effectiveness of precipitation could be lowered, especially in areas where the oil shale is closer to the surface. No adverse effects due to gas escape are anticipated for the Lofreco project because of the gas recovery system to be used.

Accelerated wind and water erosion would occur during construction and operation of the in-situ process. During this period, the vegetative cover would be partially removed and the surface would be disturbed by the necessary oil and gas recovery facilities and by vehicular traffic (1 to 10 years).

However, with implementation of erosion control measures, runoff diversion structures, and retention ponds, soil losses are expected to be minimized and considered generally insignificant. For the Lofreco project, reclamation and revegetation procedures would be implemented in phases throughout the in-situ process and are expected to be successful (Appendix R-J).

Site-Facility Disturbance

In the region, plant site facilities, construction camps, Enercor-Mono Power's proposed new town of Westwater, and the White River Reservoir would disturb 12,185 acres of mainly state and private land, of which 6,238 acres would be disturbed by the applicants' proposed projects. Plant site facilities and construction camps would disturb 4,438 acres for the life of the projects (long-term) and would be reclaimed upon abandonment. The proposed Westwater townsite (Enercor-Mono Power P.R. Springs project) would disturb 1,800 acres and would be a permanent land use conversion. The White River Reservoir, one of the interrelated projects, would inundate 1,980 acres of lands that would not be reclaimed (BLM 1982b).

R-4.A.5 WILDLIFE

It is anticipated that the proposed synfuels development would result in direct and indirect impacts to the wildlife resources through habitat losses, actual population losses, and increased pressures from people.

Habitat

The applicants' proposed projects would disturb an estimated 36,911 acres of wildlife habitat. Of these acres disturbed, about 18,330 acres would be covered by buildings and ancillary facilities and would be lost for the life of each of the various projects (Table R-4-20).

In addition to wildlife habitat removed by project facilities, there would be additional losses of habitat associated with project activities. These types of losses would be to areas of habitat that are not physically removed, but are within a zone of influence around a project area that become temporarily unusable by wildlife because of isolation, noise, dust, and similar factors. The zone of influence would be a different size for each species of wildlife under consideration, because each species has a different tolerance toward humans and their activities and each has a different cruising radius.

The applicants' projects would disturb about 36,911 acres of mule deer habitat (Table R-4-20). This represents about 2 percent of the estimated 2,318,560 acres of UDWR classified deer habitat in the area of influence. Therefore, project disturbance would not cause significant adverse impacts to deer habitat.

TABLE R-4-20

ACRES OF BIG GAME HABITAT AFFECTED BY THE APPLICANTS' PROPOSED PROJECTS
High-level Scenario

Project and Type of Habitat Removal	Critical Winter	High Priority Winter	Limited Value Winter	Critical Summer	High Priority Yearlong	Substantial Value Yearlong	Limited Value Yearlong	Riparian
Enercor (Rainbow)								
Deer								
Temporary	19	223		12			40	
Permanent	243							
Elk								
Temporary			19					
Permanent		1,279						
Pronghorn Antelope								
Temporary								
Permanent					13			
Enercor-Mono Power (P.R. Springs)								
Deer								
Temporary		180		167				
Permanent		857		5,271				
Elk								
Temporary		39					359	
Permanent	3,609	2,582					1,335	
Geokinetics								
Deer								
Temporary		359						
Permanent	3,520	2,791						
Elk								
Temporary								
Permanent	640	3,200						
Magic Circle								
Deer								
Temporary		47		3			125	6
Permanent							2,169	
Pronghorn Antelope								
Temporary					76	57		
Permanent					2,169	48		
Paraho								
Deer								
Temporary							164	
Permanment		317		400			26	
Pronghorn Antelope								
Temporary					540			
Permanent					303			
Sohio								
Deer								
Temporary					9		181	
Permanent							4,393	
Syntana-Utah								
Deer								
Temporary				492				
Permanent		3,816						
Pronghorn Antelope								
Temporary					492			
Permanent					3,816			
Tosco								
Deer								
Temporary		42			42		423	
Permanent		26		380	26		2,779	
Pronghorn Antelope								
Temporary					171	843		
Permanent					123	3,062		

TABLE R-4-20 (Concluded)

ACRES OF BIG GAME HABITAT BY THE APPLICANTS' PROPOSED PROJECTS
High-level Scenario

Project and Type of Habitat Removal	Critical Winter	High Priority Winter	Limited Value Winter	Critical Summer	High Priority Yearlong	Substantial Value Yearlong	Limited Value Yearlong	Riparian
Total Acres Removed								
Deer								
Temporary	19	851		674	51		1,292	6
Percent	0.005	0.10		0.04	0.10		0.2	0.009
Permanent	3,763	7,807		6,051	26		10,702	
Percent	1.2	0.92		1.4	0.04		1.7	
Elk								
Temporary		39	19					
Percent		0.01	0.01					
Permanent	4,249	7,061						
Percent	1.6	2.9						
Pronghorn Antelope								
Temporary					1,279	900		
Percent					.37	1.7		
Permanent					6,424	3,110		
Percent					1.8	5.9		

NOTE: The acres identified in this table will not match the estimated disturbed acres for each project (Table R-1-7, Section R-1.8), as some of the big game ranges do not cover all project facilities.

Approximately 12,249 acres of pronghorn habitat would be disturbed by the applicants' projects (Table R-4-20). This represents about 2 percent of the estimated 492,895 acres of UDWR classified pronghorn habitat available in the area. It is anticipated there would be no significant adverse impacts to pronghorn habitat from project disturbance.

The elk herd that occupies the southern portion of the area of influence inhabits about 1,036,800 acres of suitable habitat. The applicants' proposed projects would disturb an estimated 11,368 acres or about 1 percent of this habitat (Table R-4-20). Adverse impacts to the elk herd are not anticipated from such a low percentage of habitat disturbance.

It is not likely that most of the applicants' projects would affect black bear and cougar habitat; however, black bear in particular would be affected by Enercor-Mono Power's strip mining activites in the P.R. Springs area. No significant adverse impacts to vegetation habitats of other game and nongame mammal species, are expected because of the small percentage of habitat that would be disturbed by project development and the time of year anticipated for construction activities.

The loss of 11,028 acres of irrigated cropland due to predicted population increases by 1985 would cause a significant reduction in potential production of the ring-necked pheasant. This represents about a 12 percent reduction in habitat. The applicants' projects plus the interrelated projects are anticipated to remove 14,931 acres of cropland from production. This would total about a 16.6 percent reduction in pheasant habitat.

The following interrelated projects are anticipated to affect the wildlife resources of the area of influence: Bonanza Power Plant, White River Dam, White River Shale, portions of Central Utah Irrigation projects, Western Tar Sand, Ramex, C and A Tar Sand, Gary Pipeline, and Chevron Phosphate. In 1985, the peak construction year, it is estimated that approximately 52,631 acres of wildlife habitat (6,845 acres on rights-of-way and 45,786 acres on leased areas) would be disturbed by construction activities associated with the applicants' proposed projects and the interrelated projects.

Of the 52,631 acres of habitat that would be disturbed through the interrelated project activities, approximately 40,613 acres would be mule deer range. This deer range includes 4,382 acres of critical winter range; 8,975 acres of high priority winter range; 320 acres of substantial value winter range; 9,962 acres of limited value winter range; 9,793 acres of critical summer range; 77 acres of high priority year-long range; 7,098 acres of limited value year-long range; and 6 acres of riparian habitat (Table R-4-21). Of these disturbed acres, an estimated 37,717 acres would be disturbed over the long-term and 2,896 acres over the short term.

There would also be about 16,607 acres of pronghorn antelope range disturbed by these project activities within the area of influence. This includes 12,277 acres of high priority, year-long range, 320 acres of limited value year-long range, and 4,010 acres of substantial value, year-long range. Of these disturbed lands, 14,428 acres would be be disturbed over the long-term and 2,179 over the short-term.

TABLE R-4-21

ACRES OF BIG GAME HABITAT AFFECTED BY THE APPLICANTS' PROPOSED PROJECTS AND INTERRELATED PROJECTS
High-level Scenario

	Critical Winter	High Priority Winter	Limited Value Winter	Critical Summer	High Priority Yearlong	Substantial Value Yearlong	Limited Value Yearlong	Riparian
Applicants Projects[a]								
Deer								
Temporary	19	851	359	674	51		1,292	6
Permanent	3,763	7,807	1,335	6,051	26		10,702	
Elk								
Temporary		39	19					
Permanent	4,249	7,061						
Pronghorn Antelope								
Temporary					1,279	900		
Permanent					6,424	3,110		
Interrelated Projects								
Deer								
Temporary		22					2,094	
Permanent		615		3,560			2,480	
Pronghorn Antelope								
Temporary					2,094			
Permanent					2,480		320	
Total Acres Disturbed								
Deer								
Temporary	19	873		674	51		396	6
Percent	0.005	0.10		0.25	0.08		0.6	0.009
Permanent	3,763	8,422		10,285	26		14,842	
Percent	1.06	0.10		2.18	0.04		2.1	
Elk								
Temporary		39	19					
Percent		0.02	0.01					
Permanent	4,249	7,061						
Percent	1.6	2.95						
Pronghorn Antelope								
Temporary					3,373	900		
Percent					0.96	1.7		
Permanent					8,904	3,110	320	
Percent					2.57	5.9	0.34	

[a]See Table R-4-20 for totals of individual projects.

Elk habitat would also be disturbed by the combined projects for an estimated 11,368 acres. This habitat includes 4,249 acres of critical winter range; 7,100 acres of high priority winter range; and 19 acres of limited value winter range. Of these disturbed lands, an estimated 11,310 acres would be disturbed over the long term and 58 acres over the short-term.

The loss of about 52,631 acres of habitat for small nongame mammals is not expected to be a significant adverse impact because of the total numbers of acres of this type of habitat available in the area of influence.

Because of the total amount of habitat available to bird species, disturbance to bird habitats by the applicants' proposals and the interrelated projects is not expected to be significant.

Direct losses to big game populations may not occur from the cumulative effects of the applicants' proposed projects and the interrelated projects, since big game animals can easily move into adjacent habitat where project activities are not occurring. Movement of these animals into adjacent habitats would not cause significant problems if the adjacent habitat were below carrying capacity. If adjacent areas were at carrying capacity, however, competition, stress and other factors such as ongoing oil and gas development, could cause population losses. However, indirect losses to these species (such as increased poaching, wanton killing, and harassment) caused by the predicted increases in human population would increase significantly. (It is estimated that the human population in the area of influence would increase by 18,940 persons during the peak construction year (1985) and by 38,969 persons during the peak operation year (1995) (Table R-4-4, Section R-4-.A.1).) It is anticipated that big game poaching losses would increase by about 73 percent by 1985 over present levels and by about 130 percent over existing losses by 1995 (based on a straight-line projection of human population increases). Increases in poaching not only would result in game population reductions, but would also cause a monetary loss to the area. Poaching losses of this magnitude could reduce big game population levels to the point where additional hunting restrictions would be necessary in order to maintain herd size. This would also cause a significant reduction in income to the region during the hunting seasons.

Significant adverse impacts to wildlife species, particularly big game animals, would be the effect of harassment on animals already in stress situations (i.e. critical summers or winter ranges). Harassment due to construction and operation activities would result in lowered production. Energy expended by already stressed animals to escape such harassment could cause weight losses which would result in lowered productivity (Preobrazhenskii 1961; Geist 1974). In fact, in extreme cases of weight loss, death of adult animals could also occur (Geist 1974). The magnitude of these losses cannot reliably be estimated at the present time, however, they could result in significant reductions in young-of-the-year.

The removal of topsoil and its storage for later reclamation and permanent facility construction activities by the applicants' proposed projects would cause direct mortality to small burrowing rodents on an estimated 36,606 acres. However, because the reproductive rates of these animals are so high

and population turnover so rapid, large numbers (not quantifiable with present data) of these animals are produced and lost each year. Over the project life and during reclamation, even larger numbers could be projected as lost due to the applicants' proposals. While large, these losses are estimated to be less than 1 percent of the total regional small mammal population. Although these appear to be significant losses, the high reproductive potential and natural cyclic population fluctuations of these animals indicate that rapid repopulation of disturbed areas would take place once project activities were completed.

Birds

Estimated reductions of irrigated cropland (about 6,362 acres in 1985) due to population increases caused by the applicants' proposed projects would cause losses of about 7 percent of the ring-necked pheasant habitat in Uintah County. Using a straight-line project based on habitat loss, it is estimated that the pheasant harvest would drop about 800 birds (based on the 1980 pheasant harvest of 11,419 birds in Uintah County). Using an average bag of 1.09 birds per hunter day, it is estimated that 734 days of hunting would be lost to hunters. In 1980 dollars, an estimated loss of $25,881 would occur to Uintah County.

Approximately 7,024 acres of irrigated lands would be disturbed by 1985 and 14,931 acres by 1995 through population increases from the applicants' proposed projects and the interrelated projects. This would be a reduction of about 8 percent in available ring-necked pheasant habitat in the area of influence in 1985 and 17 percent in 1995.

Again, using a straight-line projection based on habitat loss and using 1980 pheasant harvest data (UDWR 1981a), it is estimated that with an 8 percent habitat loss, harvest would drop by 914 birds which translates to a loss of 838 days of hunting opportunity. In 1980 dollars, this would total a $29,548 loss to Uintah County. The 17 percent reduction in habitat would reduce the harvest by 1,941 birds or 1,781 days of hunting opportunity which would be a loss of $62,796 to Uintah County.

Nesting habitat for mourning doves would also be removed by the applicants' projects. It is anticipated that about 36,911 acres of native range and irrigated lands where doves nest would be disturbed. This loss of nesting habitat would not cause a significant reduction in dove production since the overall quality of the nesting habitat is low. It is estimated that losses in production on these disturbed areas would be less than 1 percent of the total dove production in the region.

In general, sage grouse populations in the region would not be directly affected by the applicants' proposed projects. However, the Enercor-Mono Power P.R. Springs project could have a very significant indirect effect on sage grouse in the project vicinity. There are two major strutting grounds within 3 miles of the project area and sage grouse could receive considerable harassment from project personnel watching or trying to take pictures. If

harassment levels are high enough, adult grouse could abandon the strutting grounds, severely reducing the population in this area.

Habitat of small song bird species found in the region would be disturbed by the applicants' proposed projects. An average of about 21 breeding pairs of small birds per 100 acres in various vegetation types are found in the region (BLM 1978c). Although large numbers of birds are produced and lost each year in habitats that are in a natural, undisturbed state, additional losses through project activity could be considerable. However, losses of these species are estimated to be less than 1 percent of the natural mortality in the region. In addition, because of the high reproductive potential of these birds, repopulation would be rapid as soon as habitat was available from reclamation. Therefore, no significant impacts to these species are anticipated.

The applicants' proposed projects could disturb an unknown number of raptor nest sites within the region, as there are no estimates of numbers of nests. Any disturbance of raptor nests could result in lowered production due to abandonment, which would be a significant impact.

Reptiles and Amphibians

Reptiles and amphibians would suffer direct mortality from the disturbance of about 36,911 acres of habitat due to construction of the applicants' proposed projects. Density estimates of these species are not generally known for this area, but enough is known to speculate that losses due to the applicants' proposals would quickly be replaced as soon as reclamation is completed. Therefore, no significant impacts to these species are anticipated.

Fisheries

The applicants' proposed projects are not anticipated to cause direct impacts to regional sport fisheries. However, increases in human populations associated with project development (about 26,973 new persons in the area by 1985) would increase fishing pressure on streams, rivers, and lakes in the region by about 95 percent. The increase in human population in this area due to the cumulative effect of the applicants' projects and interrelated projects would subject the regional sport fishery to an estimated fishing pressure increase of 105 percent by 1985 and 231 percent by 1995.

Significant losses to nongame fish caused by the applicants' project activities are not anticipated. Sedimentation and turbidity increases and entrapment in water diversion structures should not adversely affect these species.

Nonconsumptive Uses

Of the 44,174 new persons anticipated to come to Uintah County by 1995, it is estimated that 30 percent (13,252 persons) would make nonconsumptive use of wildlife (Allred 1976). It is also estimated that these 13,252 persons would spend at least $90 apiece in pursuit of birdwatching, wildlife photography, and general wildlife observation trips in Uintah County, spending a minimum of $1,192,698 (1980 dollars) in the county. The total estimated minimum value of the wildlife resource to Uintah County in 1980 dollars is $19,888,934 per year (UDWR 1982).

Indirect project impacts, such as poaching, wanton killing, and harassment, could significantly reduce regional wildlife populations and would have an adverse impact on a $20 million a year renewable resource.

Adverse impacts to wildlife species in Colorado are not anticipated because of the relatively small number of new people that are projected to live in Colorado and work in Utah.

The addition of 1,176 new persons to the Moffat-Rio Blanco county area of Colorado by 1985 (Section R-4.A.1, Socioeconomics) would have little or no adverse impacts on the wildlife resources of the area. Based upon data in a Utah Study (Allred 1976), it is estimated that about 33 percent of these new people would purchase a hunting licence, and of these, 94 percent would hunt big game. Therefore, an estimated 369 additional persons would hunt deer in the Colorado counties in 1985. This would increase the estimated 1985 deer hunting pressure in the two counties by 2 percent. Using the same reasoning, an additional 3,837 new persons would move into the Colorado area by 1995 (Section R-4.A.1, Socioeconomics). These people would add 1,203 additional deer hunters to the area which would be an estimated 3 percent increase over presently projected levels.

Threatened or Endangered Species

At the present time there are no known federally listed threatened or endangered mammals found in the area of influence. If black-footed ferrets are present, they could be killed by construction activities wherever prairie dog colonies occur on or along project construction areas. Present population levels of the ferret are thought to be so low that any mortality would reduce population levels very significantly.

Impacts to threatened or endangered species, whether federally or state listed, would be the same, except for magnitude, for the cumulative impacts of the applicants' projects with interrelated projects, as those indicated for the applicants' proposals alone. Wanton killing of threatened and endangered species would likely increase. Direct mortality to black-footed ferrets would be possible wherever prairie dog colonies were disturbed by the interrelated projects.

Bald eagles are not expected to be adversely affected by the applicants' project construction and operation. However, wintering populations of these birds would be very susceptible to wanton killing. Large increases in human population from the applicants' proposed projects would increase the magnitude of this problem, but the amount of impact cannot be reliably estimated at present levels of knowledge.

Impacts to the peregrine falcon and the whooping crane are not anticipated from development of the applicants' proposed projects or interrelated projects. These two species are so transient in the area of influence that even indirect impacts such as potential for wanton killing are not projected to be significant.

Adverse impacts to the three federally listed endangered fish species and the one state-designated species of concern (Table R-3-11, Section R-3.A.5) are possible for any project that takes water from the White or Green rivers via a diversion structure. Fish can be entrained in these structures and killed. The magnitude of these losses from the applicants' proposed projects or the interrelated projects cannot be reliably estimated at the present time, but reductions in population size would be significant from the cumulative effects of all the projects due to reduced flows, blockage of migration, siltation, and entrapment of young and adult fish in water diversion structures. Since population levels are very low, any losses to these species would be considered a very significant adverse impact, which is not allowed under the Endangered Species Act.

Projects that purchase water from the White River Dam Project would not adversely affect the endangered fish species in the White River because of agreed upon conservation measures in the Section 7, Biological Opinion from the Fish and Wildlife Service (FWS 1982).

R-4.A.6 AGRICULTURE

Cropland

With the exception of Magic Circle's proposed product pipeline to Roosevelt, no cropland would be affected by any of the plant site facilities or off-site rights-of-way of the applicants' proposed projects (excluding alternatives). Construction of the Magic Circle product pipeline would disturb 80 acres of cropland (Table R-4-22).

Impacts due to construction would be insignificant and short-term (1 year), because reclamation on all croplands is expected to be successful with implementation of the erosion control and reclamation procedures proposed by the applicants. Any crop losses or damages would be compensated by the applicant.

TABLE R-4-22

MAXIMUM POTENTIAL LOSSES TO AGRICULTURE FROM PROJECT CONSTRUCTION AND OPERATION
High-level Scenario

	SHORT-TERM COMMITMENT OF RESOURCES[a]				LONG-TERM COMMITMENT OF RESOURCES[b]			
Project Components	AUMs	Livestock	Cropland (Acres)	Prime Agricultural Land (Acres)	AUMs	Livestock	Cropland (Acres)	Prime Agricultural Land[c] (Acres)
Applicants' Proposed Projects								
Processing Plant and Associated Facilities	261	51	0	0	178	36	0	0
Spent Shale Disposal Area	0	0	0	0	654	130	0	0
Mined Area (Open Pit)	0	0	0	0	1,272	255	0	0
Water Pipeline	29	6	0	0	0	0	0	0
Product Pipeline	83	18	80	55	2	0	0	0
Power Transmission Lines	57	11	0	0	0	0	0	0
Access Roads	133	28	0	0	63	12	0	0
Communication Lines	0	0	0	0	0	0	0	0
Construction Camp	186	31	0	0	0	0	0	0
Natural Gas Pipeline	4	1	0	0	0	0	0	0
Off-Site Development	0	0	0	0	0	0	10,539	3,162
Subtotal	753	146	80	55	2,169	433	10,539	3,162
Interrelated Projects	536	107	0	0	660	132	3,810	1,143
Grand Total	1,289	253	80	55	2,829	565	14,349	4,305

NOTE: AUMs = animal unit months.

[a]Project elements that would be revegetated within 1 year following construction disturbance.

[b]Project elements that would remove vegetation from production for 20 years or longer.

[c]Approximate acreage figure based on assumption that approximately 30 percent of the irrigated cropland is prime agricultural land.

HIGH-LEVEL SCENARIO-AGRICULTURE

The major agricultural concern related to synfuel development is the loss of cropland, including prime agricultural land, due to the anticipated population expansion. It is predicted that during the peak construction year (1985), the population increase due to the applicants' projects would be 26,973, and by the peak operation year (1995), the population increase would be 47,906 (Section R-4.A.1, Socioeconomics). This population increase would result in expansion of the existing communities of Vernal, Jensen, Roosevelt, Ouray, and Rangely, as well as increased urban and rural development outside these communities. This expansion is predicted to eliminate an estimated 5,934 acres of cropland by 1985 and 10,539 acres of cropland by 1995 (0.22 acres per capita ARS 1971). Thirty percent of this cropland would be prime agricultural land (SCS 1981). Most of this cropland conversion would occur in the areas of Pelican Lake, Ashley Valley, and Roosevelt.

In addition to the applicants' proposed projects, interrelated projects are scheduled for development in the Uintah Basin. The cumulative effects of these interrelated projects with the applicants' projects are shown in Table R-4-23. It is predicted that during the peak construction year (1985), the population increase due to the applicants' projects and the interrelated projects would be 29,804 and by the peak operation year (1995), the population increase would be 65,222 (Section R-4.A.1, Socioeconomics). This population increase would result in increased urban and rural development that would eliminate an estimated 6,557 acres of cropland by 1985 and 14,349 acres of cropland by 1995 (0.22 acres per capita ARS 1971). Thirty percent of this cropland would be prime agricultural land (SCS 1981a).

The cropland that would be affected currently produces average yields of approximately 3.9 tons of alfalfa hay, 1.8 tons of meadow hay, 61 bushels of oats, 73 bushels of barley, and 19 tons of corn silage per acre (ASCS 1981; State of Utah 1981). Table R-4-23 shows the cumulative annual crop production losses based on these average-per-acre yield estimates. These losses would affect the local economy (Section R-4.A.1, Socioeconomics) and also would affect individual ranchers and farmers, although neither the exact numbers nor the exact locations are available at this time. However, it is predicted that some farmers and ranchers would no longer continue in agricultural business due to the pressure for new homesites and related urban support facilities, and due to the increase in taxes resulting from the predicted population growth and changes from rural to industrialized and urban communities.

The predicted agricultural production loss represents 17 percent of the production that occurred in the region in 1980. This loss would significantly affect the agriculture sector of the economy (Section R-4.A.1, Socioeconomics) and also significantly reduce cropland acreage.

The area most strongly affected by cropland conversion would be the Ashley Valley. The ten-year projection of land use change in the Ashley Valley area made by a group representing Uintah County Commissioners, Vernal City Planner, oil companies, irrigation companies, Uintah Basin Soil Conservation District,

TABLE R-4-23

CUMULATIVE PREDICTED ANNUAL CROPLAND AND CROP PRODUCTION LOSS
High-level Scenario

Project Scenario	Year	Cropland Lost (Acres)	Principal Crop Production Loss[1] Alfalfa Hay (Tons)	Meadow Hay (Tons)	Oat (Bushels)	Barley (Bushels)	Corn (Silage) (Tons)
Applicants' Proposed Projects	1985	5,934	15,043	1,495	21,718	25,991	3,750
	1995	10,539	26,716	2,656	38,573	46,161	8,010
Applicants' Projects With Interrelated Projects	1985	6,557	16,622	1,652	23,999	28,720	4,983
	1995	14,349	36,375	3,616	52,517	62,849	10,905

[1]Crop production loss figures are for the principal crops grown on 95 percent of the cropland with the following crop distribution: alfalfa hay 65 percent, meadow hay 14 percent, oats 6 percent, barley 6 percent, and corn for silage 4 percent.

and Uintah County Agricultural Stabilization and Conservation Service Executive Director shows a total of 11,870 acres being converted from agriculture to urban uses. It is also predicted that 86 percent of the urban development would be on irrigated lands, which represents approximately 34 percent of the total cropland of Ashley Valley (SCS 1981a).

Until 1972, agriculture (farming and ranching) was the main economic source in the region. Since then, nonagricultural industries, mainly petroleum exploration and production and tourism, have experienced growth and contributed to the regional economy. This trend would be strengthened by the proposed synfuels projects and the agricultural sector would decline proportionately in economic importance.

Livestock Grazing

Forage production would be affected through the land being taken out of production as shown by potential losses to agriculture (Table R-4-22). Long-term loss of forage would result from land being occupied by buildings, open pit mines, roads, or other structures for 10 years or longer. This would result in a loss of 2,169 AUMs of forage or a loss of production for 79 head of livestock, considering a 5-month grazing season. Short-term losses of forage for 1 to 10 years would result from disturbance by the construction of pipelines, roads, power transmission lines, and construction disturbance near buildings and mine sites. This disturbance would cause a loss of 753 AUMs or 146 cattle for a 5-month grazing season on BLM and state land or a 6-month season on Uintah and Ouray Indian Reservation land. The greatest disturbance would be on state lands from construction of processing plants and mines. Construction within rights-of-way would be primarily on BLM, Uintah and Ouray Indian Reservation, and private lands. Refer to Map R-A-3, located in Appendix R-A, for location.

Total livestock carrying capacity for the area of influence is 195,755 AUMs for an average 5-month grazing season, which converts to 39,150 head of cattle. Loss of forage from the applicants' proposed projects would be 1.4 percent of the study area total carrying capacity. This loss would be considered insignificant on an area-wide basis.

Impacts could be significant to two individual operators who use the allotments on state land where open pit mines and plant sites proposed by Sohio and Geokinetics would be located. Potential losses would total 3 percent for each of the operators. This impact looses significance, because actual use on the allotments is less then 75 percent in most instances (BLM 1981b), which would cancel any effect from loss of AUMs due to construction. Thus, the overall impact would be insignificant from the limited reduction of the winter portion of the year-round operation. Loss of grazing capacity from linear rights-of-way proposed for lands administered by the Bureau of Indian Affairs would also be insignificant, because the loss of forage would be spread over a narrow band that would average less than 1 AUM per mile of construction.

The Enercor-Mono Power P.R. Springs open pit operation would remove 23 percent of the grazing capacity of one allotment; the plant site would remove an additional 1 percent. These disturbances would total 24 percent or 550 AUMs of grazing capacity and would be confined to state lands. An additional 275 AUMs would be temporarily lost from construction of rights-of-way facilities on federal lands. However, several grazing allotments would be crossed, and the impact to any single allotment would not be significant due to the scattered nature of the disturbance.

Overall impact from the project would be significant due to the high percentage of forage (AUMs) lost on the one allotment located on state lands.

Increased livestock road kills caused by increased traffic, changes in grazing patterns caused by new structures, and disturbance to grazing animals from increased traffic or ORV use could become significant near the peak construction year (1985) and would increase as the population peaks during peak operation (1995).

R-4.A.7 TRANSPORTATION NETWORKS

Highways

For the high-level scenario, traffic projections for the applicants' projects indicate that more than 12,000 commuter trips per day would be generated and the level of service of some roads would drop to an unacceptable level. An unacceptable level is considered to be service levels D, E, or F as defined by the American Association of State Highway and Transportation Officials (1965). Brief descriptions of these levels are included on Table R-4-24.

As shown on Tables R-4-24 and R-4-25, U.S. 40 would be expected to carry a major portion of the traffic projected in the area of influence; however, as dirt roads are upgraded to provide improved access to the synfuels projects, traffic patterns throughout the Uintah Basin could change to bring increasing traffic to the interior of the basin south of U.S. 40.

By 1985, traffic increase resulting from applicants' developments would reduce all identified segments on U.S. 40 (Utah) to unacceptable levels except for the road sections from Jensen to SR 45 and SR 45 to Utah-Colorado line. The roadway segment on U.S. 40 (Utah) from Colorado border to SR 264 (Utah) would be the most severely dropping from C to F unless improvements were made. U.S.40 (Utah) segments from SR 88 to Jensen would also be severely affected with the projected baseline level of service dropping from C to E, with the applicants' development. Adding the interrelated projects would make the traffic impacts worst and would cause the U.S. 40 section from SR 264 to SR 88 to drop from a baseline of B to E under the cumulative situation. The SR 64 (Colorado) from Rangely to Dinosaur would become unacceptable with the applicants' projects, interrelated projects, dropping from a baseline level of C to D.

In 1995, two segments on U.S. 40 (Utah) would have unacceptable levels of service under the baseline. These are from Colorado line to SR 264 and Vernal

TABLE R-4-24

PROJECTED AVERAGE ANNUAL DAILY TRAFFIC DUE TO APPLICANTS' PROPOSED PROJECT
High-level Scenario

Highway Link	Number of Vehicles 1985	1995	Level of Service[a] 1985	1995
U.S. 40				
County Line to County Road 264	10,048	15,977	F	F
County Road 264 to SR 88	7,432	11,767	D	F
SR 88 to Vernal	8,433	13,485	E	F
Vernal to Jensen	7,403	12,239	E	F
Jensen to SR 45	3,309	5,449	C	D
SR 45 to Utah/Colorado Border	3,267	5,282	C	D
Interstate 70				
SR 163 to Utah/Colorado Border	4,175	6,801	A	A
SR 88				
U.S. 40 to County Road 264	4,241	6,727	C	F
County Road 264 to Ouray	4,296	6,798	C	F
New Road "C"	1,254	2,391	A	B
SR 45				
Northern	622	780	A	A
Southern	638	801	A	A
New Road "D"	1,914	1,627	A	A
Colorado 64				
Dinosaur to Rangely	6,032	9,877	C	F
New Road "A"				
Vernal to SR 45	3,421	4,688	B	C

[a]American Association of State Highway and Transportation Officals (1965) Levels of Service. A = free traffic flow, accompanied by low volumes and high speeds; B = stable traffic flow, with operating speeds beginning to be restricted by traffic conditions; C = stable traffic flow, but drivers are restricted in their freedom to select speed, change lanes, or pass; D = approaches unstable traffic flow, with fluctuations in volume and temporary restrictions to flow, which may cause substantial drops in operating speeds; E = unstable traffic flow, with momentary stoppages; F = forced traffic flow, with low speeds and short or long stoppages because of downstream congestion.

TABLE R-4-25

PROJECTED AVERAGE ANNUAL DAILY TRAFFIC DUE TO APPLICANTS' PROPOSED PROJECTS AND INTERRELATED PROJECTS
High-level Scenario

Highway Link	Number of Vehicles 1985	1995	Level of Service[a] 1985	1995
U.S. 40				
County Line to County Road 264	10,421	19,163	F	F
County Road 264 to SR 88	7,827	14,235	E	F
SR 88 to Vernal	8,907	16,430	E	F
Vernal to Jensen	7,620	14,158	E	F
Jensen to SR 45	3,411	6,319	C	E
SR 45 to Utah/Colorado Border	3,404	6,249	C	E
Interstate 70				
SR 163 to Utah/Colorado Border	28,875	31,501	C	C/D
SR 88				
U.S. 40 to County Road 264	4,241	6,727	C	F
County Road 264 to Ouray	4,296	6,798	C	F
New Road "C"	1,254	2,391	A	B
SR 45				
Northern	742	1,121	A	A
Southern	758	1,142	A	A
New Road "D"	2,553	5,597	B	C
Colorado 64				
Dinosuar to Rangely	6,239	11,526	D	D
New Road "A"				
Vernal to SR 45	4,107	8,486	C	E

[a]American Association of State Highway and Transportation Officals (1965) Levels of Service. A = free traffic flow, accompanied by low volumes and high speeds; B = stable traffic flow, with operating speeds beginning to be restricted by traffic conditions; C = stable traffic flow, but drivers are restricted in their freedom to select speed, change lanes, or pass; D = approaches unstable traffic flow, with fluctuations in volume and temporary restrictions to flow, which may cause substantial drops in operating speeds; E = unstable traffic flow, with momentary stoppages; F = forced traffic flow, with low speeds and short or long stoppages because of downstream congestion.

to Jensen. No other segment within the analysis area would have unacceptable levels under the baseline. With the applicants' impacts, levels of service on all U.S. 40 (Utah) segments would be unacceptable. From the Colorado line to Jensen, service levels would be F. State Route 88 (Utah) from U.S. 40 to Ouray would have levels of service reduction from baseline levels of A to F. State route 64 (Colorado) from Dinosaur to Rangely would decrease from C under the baseline, to F with the applicants' projects. Adding, interrelated projects, virtually all segments within the analysis area would drop to F except for I-70 (Utah) and U.S. 40 (Utah) segments from Jensen to the Colorado line. The local county roads 262 and 264 as well as other roads in the basin and within the Uintah and Ouray Indian Reservation would not be able to handle the increased traffic without upgrading and an expanded maintenance program. The level of service would also be lowered on Colorado 139 (from Rangely to Mack), Seep Ridge Road, and SR 44 to the Utah-Wyoming border. Increased traffic on all these roads would increase accident rates, highway litter, range fire potential, and animal road kills. The traffic would also encourage business expansion along these road systems, potentially creating new high density areas. Measures to offset some of the impacts would necessitate large expenditures for road improvement and increase maintenance.

Information on volume-to-capacity calculations and level of service is discussed in more detail in the Socioeconomics Technical Report (State of Utah 1982b).

The prime railhead likely would be Salt Lake City, Utah, or Mack, Colorado, which would generate significant truck traffic. Extremely heavy loads which require special equipment would probably be brought by rail to Mack, Colorado, for off loading on to oversize trucks. This would temporarily affect Colorado Highways 139 and 64 as well as the specific local roads that would be used to move the equipment to each one of the project sites.

Air

With the substantial increases in population, there would be an increased demand for air travel at all airports in the study area. For example, the potential would exist for operations (take-offs and landings) at the Vernal airport to increase more than eight times over the current use. This would require considerable expansion of the airport accommodations. Commuter airline passenger bookings would increase; but at present levels of knowledge, it is not possible to quantify this increase.

Public Transportation

It is assumed there would be a significant positive impact to the private bus companies, Continental Trailways and Wilkins Transportation Company, based on the assumption that the projected increases would generate increased passenger demand.

R-4.A.8 RECREATION

The implementation of the applicants' proposed projects and interrelated projects within the area of influence would disturb approximately 52,631 acres of the land base for outdoor recreation use. However, there would be a greater impact to recreation users by the increased number of persons recreating in the region. It is predicted that in 1985, the peak construction year, the eight county area of influence (Uintah, Duchesne, Daggett, and Grand counties in Utah, and Rio Blanco, Moffat, Garfield and Mesa counties in Colorado) would have a projected baseline population growth of 166,415 and would experience an additional increase over baseline of 33,930 due to the applicants' proposed projects and other interrelated projects. By 1995, the peak operation year, a projected baseline population growth of 195,732 people is predicted for the same eight counties. The eight counties would have an additional 72,857 people due to the cumulative regional growth of the applicants' proposed projects and interrelated projects (Section R-4.A.1, Socioeconomics).

The increased number of people living, working, and traveling to the Uintah Basin for outdoor recreation pursuits would cause three basic impacts. First, there would be conflicts between the recreationists and landowners due to increased numbers of people crossing private and Indian land. This would likely prompt the landowners (Ute Indian Tribe and private citizens) to restrict access to and across their land, thereby making access to favorite recreation areas more difficult. Second, the typical dispersed type of outdoor recreation experiences enjoyed on federal lands within the region (impromptu camping and day use activities) would be greatly increased. As a result of the predicted population growth, there would be greater conflicts between recreation users, greater hunter contacts, more noise, and increased amounts of ambient dust, which would affect the quality of semi-primitive and primitive camping experiences. Third, with more recreation use predicted for federal and state lands, the responsibility for and difficulty of protecting valuable resources would increase. Poaching, wanton killing of wildlife, stealing and vandalism of cultural resources, fishing limit violations, and visitation to National Park Service units would increase with the predicted population growth. These factors would diminish the quality of recreation experiences for most users and would cause a general decline in the recreation resource.

The overcrowding of developed recreation areas and facilities would also occur, particularly during the peak summertime tourist season, holidays, and weekends. Those areas that are currently popular recreation areas within the region would receive proportionately greater use pressure. These areas include campgrounds and marinas at Flaming Gorge, Steinaker, Red Fleet, Starvation and Bottle Hollow reservoirs; National Park Service units such as Arches National Park, Dinosaur and Colorado National Monuments; river running segments of the Yampa River, the Colorado River through Westwater Canyon, and the Green River below Flaming Gorge Dam and Desolation and Gray canyons; and Utah and Colorado state parks.

Water-Oriented Activities

Implementation of the applicants' proposed projects would remove portions or all of the White and Green rivers from any future consideration as National Wild and Scenic Rivers. The quality of river running experiences along these river segments would be diminished by proposed water diversion structures, new access roads, bridges, power transmission lines, and visible surface disturbance from spent shale disposal areas and retention ponds. Significant impacts upon the "natural, cultural, and recreation values" (Federal Register 1980a) of the affected segments of these two rivers would result (See Map R-A-3, located in Appendix R-A, for locations). The feeling of remoteness and the relatively undisturbed nature of the canyons and river banks, would be lost to the sights and sounds of humanity, thus significantly affecting the quality of river running through these river segments.

Enercor-Mono Power's proposed townsite at Westwater, Utah, would also have a significant impact on a portion of the Colorado River being considered as a National Wild and Scenic River (NPS 1979). The townsite would be located on the west bank of the Colorado River and could be incompatible with the spirit and intent of the Wild and Scenic Rivers Act (P.L. 90-542), thereby eliminating a portion of the Colorado River from inclusion into the national system. The final determination of this point would be made by Congress.

The anticipated increased population growth in the area of influence would create a substantial increase in demand for float trips, especially down the Yampa River; the Green River below Flaming Gorge Dam, through the Dinosaur National Monument and the Desolation and Gray canyons; and the Colorado River through Westwater Canyon. This increase in demand for float trips would be most acute at the north end of the Westwater Canyon where the proposed town of Westwater with a predicted population of between 12,000 to 15,000 persons by 1995, would be located. These river segments are under the NPS or BLM permit system (during late spring, summer, and early fall); nevertheless, certain potential impacts would be likely. Controlling river access, maintaining a solitude running experience, controlling illegal (nonpermitted) river runners, and most importantly, maintaining the health and safety of river runners would become increasingly more difficult for federal land managers.

Based on the expected population growth, fishing in the several rivers, reservoirs, and lakes within the region would increase. This increase in fishing pressure would generally make it more difficult for individuals to achieve high quality fishing experiences.

The Flaming Gorge, Red Fleet, Steinaker, and Bottle Hollow reservoirs, Pelican Lake, the area below the Flaming Gorge Dam on the Green River, and lakes and streams in the High Uinta Mountains would likely receive the greatest increases in fishing pressure due to their relatively close proximity to Vernal, Utah, where the majority of the project-related work forces likely would reside. The expected increases in demands for fishing would cause secondary impacts such as need for increased funding for fish hatcheries and stocking programs. This would especially be true for the Ute Indian Tribe, which sells permits for fishing within the Uintah and Ouray Indian Reservation and is dependent on governmental agencies for stocking.

Boating and sailing would also be expected to proportionately increase with population growth. The greatest use pressures would occur at the Flaming Gorge, Red Fleet, Steinaker, and Bottle Hollow reservoirs, and Pelican Lake.

Land-Oriented Activities

The applicants' proposed projects would significantly diminish the quality of hunting experiences within the area of influence due to several factors. Project construction, which would disturb approximately 52,631 acres, and concentrated human activity could displace nearby wildlife. Project-related population growth would cause an increase in hunting, resulting in greater hunting contacts and less hunting success. As a result of the additional people in the area, the incidences of poaching and wanton killings of wildlife, especially in the areas of the proposed construction camps also would be expected to increase (Bradley 1976), further reducing the number of game animals in the area.

Experiences in hunting areas adjacent to the proposed project sites as well as other popular hunting areas within the area of influence would be affected. These other areas include the proposed High Uintas Wilderness Area; the Flat Tops Wilderness Area; the Bookcliff Mountains in the P.R. Springs area; the Ouray National Wildlife Refuge, areas near Dinosaur and Colorado National Monuments and Arches National Park; bottomlands of the White, Green, and Colorado River drainages; and upland game hunting areas north of the White River.

The predicted population influx due to the applicants' proposed projects and construction of proposed new access roads would also result in greater ORV and sightseeing use, especially during weekends when use tends to peak. The new roads would provide access to previously remote areas, which would create new ORV opportunities. However, federal land managers within the region and the Ute Tribe could have greater problems in avoiding indiscriminate cross-country travel, proliferation of new roads and trails, and disturbance and destruction of soils, vegetation and wildlife species, and cultural resources. Increased ORV use could result in increased harrassment of livestock and ranchers. It would also create problems for the proposed synfuel project managers in keeping the curious from trespassing on project areas.

The increased population would also place a greater demand on camping, both at established camping areas as well as upon prime dispersed camping sites located along water sources or scenic vista points. New campgrounds on federal, state, and private lands would be necessary to accommodate the expected increased camping needs for an increased population. For example, already the effects of population growth on those individuals seeking quality camping facilities are being felt in the Dead Horse Point State Park where the 25 campsites receive nearly 100 percent capacity usage during the peak summertime use season. The same situation also exists at the Bottle Hollow campground, located west of Vernal, Utah, where the 90 campsite units receive 100 percent occupancy during summertime weekend use (Uintah and Ouray Agency

1982). The predicted increased demand for diverse camping opportunities (primitive, semi-primitive, and convenience-oriented) would result in the need for new funding and the necessary staff to manage this use.

Lastly, hiking would also be expected to increase within the region due to population growth especially within the proposed High Uintas Wilderness Area and other remote areas where day use hiking and overnight backpacking trips are common in the summertime. This would mean greater hiker contacts between hikers, horse packing, and possibly ORVers; ultimately diminishing the quality of hiking experiences for those who desire a more primitive and solitary experience. The use of the Dominguez-Escalante Trail (under consideration as a National Historic Trail), which generally parallels U.S. Highway 40, would also be expected to increase. However, since the trail through the eastern half of the Uintah Basin is hiked minimally, the increased use generally would not seriously affect hiking experiences.

Municipal and County Recreation Opportunities

The majority of the increased population predicted for the region would reside in the existing communities of Vernal and Roosevelt, Utah, Rangely, Colorado, and the proposed new community of Westwater. By 1985, the peak construction year, a 66 percent increase over baseline is projected for Vernal due to the applicants' proposed projects plus other interrelated projects; a 63 percent increase over baseline is projected for Roosevelt; and a 15 percent increase over baseline is projected for Rangely (Table R-4-4, Section R-4.A.1). The expansion of these existing communities and the establishment of Westwater would necessitate adequate community centers, new community park areas, movie theaters, bowling alleys, swimming pools, and racquetball, tennis, and basketball courts to meet the urban recreation needs of these communities.

Vernal currently needs an additional indoor swimming pool facility (DOE 1981). Uintah Recreation Association facilities (composed of the City of Vernal, Uintah School District, and the Church of Jesus Christ of Latter Day Saints (Mormon)) are currently being used to capacity (BLM 1981c). Thus, the immediate outlook for Vernal municipal recreation opportunities is for crowded facilities and a resultant decline in user satisfaction. Roosevelt currently needs a new year-round swimming pool. The existing outdoor pool is over 25 years old and is in constant need of repair. A new recreation community center is also needed (Eschler 1982). With the predicted expanding population, existing facilities would receive greater use, reaching over crowded conditions in terms of achieving user satisfaction. Rangely would need additional day use park acreage, since the existing city parks currently are overused (Bartlett 1982).

By 1995, the peak operation year, Vernal and Roosevelt as well as Grand County (due to Enercor-Mono Power's proposed new townsite at Westwater, Utah) would be expected to have its municipal and county recreation facilities further stressed. For Vernal, the projected increase over baseline due to the applicants' proposed projects and other interrelated projects would be 61 percent; for Roosevelt it would be 70 percent; for Rangely it would be 21

percent; and for Grand County it would be 116 percent (Table R-4-4, Section R-4.A.1). These population increases would result in crowded recreation facilities and a significant decline in user satisfaction.

Construction camps located on the project sites also would have especially critical recreation needs. Such camps in the past have typically neglected to provide adequate activities for their workers. The fact that families would not be present only intensifies the need for recreational activity. All of the applicants' have stated that their construction camps would include recreation facilities. However, the facilities that would be provided are unknown at this time. Therefore, it is not possible to evaluate their adequacy. Unless the construction camps are properly developed to facilitate the recreation needs of construction workers, significant adverse effects could occur, causing worker morale problems, increased crime, alcoholism, and drug abuse (DOE 1981).

R-4.A.9 WILDERNESS

The implementation of the applicants' proposed projects would result in direct and indirect impacts to proposed and existing wilderness units within the secondary zone of influence (the area within a 2-hour driving distance from Vernal, Roosevelt, or Westwater, Utah, or Rangely, Colorado). These units are identified on Table R-3-17, located in Section R-3.A.8. Of special concern are the potential impacts of the conceptual Enercor-Mono Power P.R. Springs project.

Components of Enercor-Mono Power's P.R. Springs project would be in direct conflict with the 43,963-acre Winter Ridge area, a proposed wilderness unit. Approximately 6,400 acres of the project would lie within the Winter Ridge area (Map R-A-3, located in Appendix R-A). The Winter Ridge area is currently being managed by the BLM to protect its wilderness characteristics (BLM 1980a). Whether this unit would be returned to multiple-use management or formally designated as a Wilderness Study Area (WSA) is expected to be decided by the Interior Board of Land Appeals (IBLA, Case #81-648).

The population of the proposed town (predicted to be between 12,000 to 15,000 by 1995), would also cause significant indirect impacts upon the Westwater Canyon WSA. These adverse indirect impacts, primarily due to people pressure upon wilderness values, likely would impair such wilderness characteristics as solitude, destroy plant and animal life, create visual intrusions, increase the potential for vandalism of cultural resources, increase wildlife disturbance (especially bald and golden eagles, peregrine falcons, and deer) and habitat deterioration. Access into the WSA would need to be controlled to sustain solitary experiences for river runners, hikers, and equestrians. In addition, the potential exists for air quality degradation from the proposed town and the related negative affects upon wilderness resource values. The potential for illegal use of off-road vehicles, illegal firewood and Christmas tree cutting could occur with a proposed town of 12,000 to 15,000 people.

Of positive benefit could be the emergence of a new recreation-based economy for the proposed town due to backpackers and outfitters wanting to explore and enjoy the wilderness resource values.

Similar indirect population growth and use pressure impacts would also be expected on the Utah state roadless area near the Uintah-Grand county line and the Wilderness Area on the Hill Creek extension of the Uintah and Ouray Indian Reservation.

Development of all the applicants' proposed projects would result in a combined population increase that would cause indirect adverse impacts to the proposed and existing wilderness units within the secondary zone of influence. Nearly a third of the visitation to area wilderness units would be attributed to the population increase that would be caused by the applicants' proposed projects. Should any of these wilderness units become part of the National Wilderness Preservation System, visitation would further increase (FS 1978; Hendee, et al. 1968).

The projected visitor use increase would likely cause serious adverse impacts to the quality of the wilderness experience at the following units before affecting other less visited wilderness units:

Flat Tops Wilderness Area, because it is currently the closest Wilderness Area to the Uintah Basin, and is noted for hunting, fishing, backpacking, and other recreation opportunities;

Proposed High Uintas Wilderness Area, due to its outstanding elk and deer hunting and other recreation opportunities;

Desolation Canyon and Westwater Canyon WSAs, because of their noted river running, cultural, hiking, and hunting values; and

Arches National Park and the Colorado and Dinosaur National Monuments, because of their scenic and science/geologic interest.

Based on a three calendar year (CY) linear projection for 1981 to 1983 which does not include new energy development within the Uintah Basin, the National Park Service predicts a 29 percent increase in visitor use for Arches National Park (319,144 recreation visits in CY 1981 to 412,693 in CY 1983); a 29 percent increase for the Colorado National Monument (309,344 recreation visits in CY 1981 to 400,258 in CY 1983); and a 29 percent increase for Dinosaur National Monument (340,076 recreation visits in CY 1981 to 439,229 in CY 1983) (NPS 1981). With the expected population increase from the applicants' proposed projects, potential visitation to the national parks and monuments would likely cause adverse impacts to the quality of the wilderness park experience, through visitor control problems, potential use conflicts, and general resource deterioration.

In addition to the applicants' proposed projects, other interrelated projects (Tables R-1-2 and R-1-3) are scheduled for development within the Uintah Basin. By 1985, these interrelated projects would increase the population by an additional 11,850 persons above the increase caused by the applicants' projects' population growth, for a total increase of 33,930 in the eight counties within the area of influence (Uintah, Duchesne, Dagget, and Grand counties, Utah; Rio Blanco, Moffatt, Garfield, and Mesa counties, Colorado). By 1995, the interrelated projects would increase the population by 22,729 people above the applicants' projects' population growth, for a total of 72,857 in these counties. These population increases would further accentuate the serious adverse impacts on the regional wilderness resource base, resulting in a general decline in wilderness experiences and resource deterioration through increased use pressure and the effects of air quality degradation (refer to Section R-4.A.2, Air Quality, for additional details).

R-4.A.10 CULTURAL RESOURCES

The applicants' proposed projects would cause land modification from construction of the processing plants, access roads, power transmission lines, pipelines, and spent shale disposal areas. Land modification would also occur from surface activities associated with the shale and tar sand mines and the construction camps.

The applicants' proposed projects would cause a population increase, which in turn would increase the amount of ORV use and other activities, ultimately causing land modification, vandalism, and relic collecting. This would affect all known and unknown cultural resources within the region, including those on the Uintah and Ouray Indian Reservation.

Land modification from project construction, mining, increased people in the area, and relic collecting would have an adverse effect on cultural resources. The impacts to cultural resources from these activities would include destruction or alteration of the resources, displacement of artifacts, alteration of the surrounding environment, and introduction of visual, audible, and atmospheric elements out of character with the present environment. These impacts would cause a loss of scientific and cultural information and a loss of a portion of the resource base for future research.

The impacts from population increase are particularly significant, because the type of data removed by these activities are the major resource for dating and analyzing prehistoric activity. Cultural resources are nonrenewable; consequently, the loss of any information could have a significant impact on efforts to reconstruct the prehistory and history of the region.

The impacts to cultural resources from the applicants' projects plus interrelated projects would be the same as described for the applicants' projects but would have greater intensity, since more acres would be disturbed and more people would be involved.

R-4.A.11 VISUAL RESOURCES

Landscape contrasts that would create significant adverse visual impacts as a result of implementing the applicants' projects are summarized on Table R-4-26. They are based primarily upon results of analysis learned by applying the BLM Visual Resource Management (VRM) System (BLM 1978a). Refer to Appendix R-H, Visual Resource Management Methodologies, for a further discussion of the analysis technique. Contrast ratings were determined by evaluating the extent to which construction and operation of the projects would create visible contrasts with the form, line, color, and texture of the existing landscape features. The extent of contrast was then translated into adverse or beneficial impacts.

The amount of contrast that would be acceptable in any particular area is limited by the VRM class in which the area is located, since a maximum degree of contrast is set for each VRM class. The locations of each VRM class are generally described in Section R-3.A.11, Visual Resources. Potential areas of impact were determined based upon scenic quality or visual variety of the landscape (moderated by the existing industrialized nature of the region), visual sensitivity, and viewing distance. The duration of viewing, number of viewers, viewer attitude toward changes in the landscape, angle of observation (including that from commercial aircraft), ease of recontouring and revegetation, and construction and restoration methods (discussed in Chapter R-3.A.4, Vegetation, Soils, and Reclamation, and Appendix R-J) were all considered in analyzing the degree of contrast.

The contrast evaluation was concerned only with the residual effects of construction and operation such as changes in the landform, removal of vegetation, and placement of permanent structures in viewed areas. All other impacts were considered insignificant because construction crews and equipment would be visible only temporarily and would not place significant impacts on the visual resource of the area. Facility and mine maintenance and abandonment, other than the effects upon air quality visibility (see Section R-4.A.2, Air Quality), would have little or no adverse effect on the visual landscape, as opposed to construction and operation impacts.

The length of time the impact would be viewed was considered when determining the contrast rating for the proposed projects and alternatives located in the various VRM classes. Changes directly related to vegetation that would be mitigated through revegetation, as described for the applicants' proposed projects, and within one or two growing seasons were considered temporary and thus, insignificant. The same rationale applies to landforms that would be recontoured during construction. These changes would also be temporary and insignificant. In other areas in which the visual contrast would not recover to an acceptable level easily, significant visual contrasts would remain longer. These include steep, rocky areas where landform changes would remain longer, and steep, dry slopes or any areas of low precipitation where revegetation would be difficult. Modifications that would be noticeable for 2 to 5 years would be short-term; those that would be noticeable from 5 years through the project life would be long-term. Long-term contrasts created by

TABLE R-4-26

SIGNIFICANT ADVERSE REGIONAL VISUAL RESOURCE IMPACTS[a]
High-level Scenario

Project	Total Acres Disturbed[b]	VRM Class II (acres affected)	VRM Class III (acres affected)	VRM Class IV (acres affected)
Enercor (Rainbow)	1,737	72	435	1,230
Enercor-Mono Power (P.R. Springs)	8,343	165	450	7,728
Geokinetics	9,344	172	2,730	6,442
Magic Circle	2,491	78	980	1,433
Paraho	1,087	182	370	535
Sohio	4,583	24	1,090	3,469
Syntana-Utah	4,386	48	330	4,008
Tosco	4,940	187	2,030	2,723
Combined Applicant Total	36,911	928	8,415	27,568
Interrelated Projects	15,720	348	3,205	12,167
Cumulative Total	52,631	1,276	11,620	39,735

NOTE: Refer to Appendix R-H for a description of the various Visual Resource Management (VRM) classes.

[a]The combined impacts of the site-specific projects are greater when viewed at the regional level than when assessed on an individual basis, because the visual character of the regional landscape would change from an essentially natural character to one highly modified by man. All impacts would be long-term because of length of time required for revegetation.

[b]Refer to Table R-1-7 for a breakdown of acres disturbed by the various elements of each project.

forming spent shale disposal piles, clearing vegetation for the facilities, and adding of structures would be the predominant adverse impact of the projects.

The growth patterns of shrub and woodland types would be affected by the straight lines created by right-of-way clearing techniques. Because of the regenerative nature of these species, coupled with poor growing conditions, these impacts would generally be long-term. The degree of contrast acceptable for the VRM class of the area where the changes would occur, determines final significance. Revegetation would produce color contrast with existing vegetation, emphasizing the contrast in line.

Visual impacts directly related to the addition of physical structures to the landscape would be significant only if they contrasted significantly with the natural setting; the degree of contrast determined by the contrast rating system. Such structural impacts would be emphasized by transmission towers and plant facilities where cleared vegetation and the scale and design configuration of the facilities would make them highly visible. The resulting visual contrasts would detract from the natural landscape setting.

It should be noted that the total acreages of significant adverse impacts to the visual resource would be cumulatively much greater on a regional basis if all or most of the projects were implemented than just the sum of all the acres of impacts of the individual site-specific projects. The reason for the "whole is greater than the sum of the parts" phenomonen is that no individual project in and of itself would change the basic visual character of the region. However, when all of the linear systems and plant site areas of disturbance are overlain on the regional landscape, the character of the existing, essentially natural-appearing landscape would change to one of a highly man-modified character. Table R-4-26 reflects such a cumulative effect.

R-4.A.12 PALEONTOLOGY

Impacts to paleontological resources would consist of unquantifiable losses of plant, invertebrate, and vertebrate fossils. A number of fossils could be destroyed during construction. Increased collecting and removal of known fossils in the region would likely result from increased numbers of people within the area.

R-4.A.13 MINERAL AND ENERGY RESOURCES

Over the life of the applicants' proposed projects, about 2,467.4 million tons of oil shale would be mined; an additional 1,644.9 million tons would be left in place, which under present technology would be lost. The total recoverable and nonrecoverable oil shale, 4,112.3 million tons, would amount to about 0.5 percent of the total recoverable oil shale resources in the basin (825 billion tons (Smith 1981)). In addition, some 513 million tons of tar sand also would be mined. See Table R-1-9 for the amounts of oil shale ore tar sand that would be mined by individual projects.

TABLE R-4-27

COMPARISON OF EFFICIENCIES OF ENERGY PRODUCTION
FROM OIL SHALE AND OTHER ENERGY SOURCES

Type	Percent Efficiency
Shale Oil From an Underground Mine	30
Crude Oil to Petroleum Products	30
Electrical Power from Coal	
Strip Mines	33
Underground Mines	31
Uranium to Electricity	17
Electrical Power from Natural Gas	35
Oil from Tar Sand Strip Mines	44

SOURCE: BLM 1982a.

The applicants' projects would use the oil shale and tar sand to produce 506.33 trillion British thermal units (Btu's) of energy. After adding in external uses (i.e., electricity) of 219.92 trillion Btu's, an estimated 351.44 trillion Btu's would be produced. This represents an overall efficiency of 48.4 percent of the resource. Considering the total in-place energy, including the ore that would be left in place during room-and-pillar mining, the overall efficiency would be about 30 percent. For a comparison with other energy sources, see Table R-4-27.

Overall energy efficiency is defined as the net energy output divided by the net energy input times 100. Net energy outputs are basically the Btu's contained in the products and by-products. Net energy inputs are more complex, but they can be broken down into sections, each of which can be dealt with separately and combined in various ways as needed. The major sections are:

1. Mining the oil shale or tar sand.
2. Transporting the ore and other needed material, such as water, to the processing plant.
3. Processing the raw material; retorting or extracting, and upgrading.
4. Transporting the products, by-products, and waste products.
5. Indirect energy, which includes energy needed to produce the final products and equipment to do the job.
6. Infrastructure energy, which includes energy used by the employees of the project, their families, and secondary industries (including social services).

The final project efficiency would vary from site to site. Some of the factors affecting the final efficiency are:

1. The amount of oil in a ton of ore.
2. The depth of the zone to be mined or the cost of moving the ore to the processing plant.
3. The distance water and other fuels have to be transported to the site.
4. The distance the oil must be transported to the refinery.

Considering these factors, the location of a project has more to do with the overall efficiency than the process used to extract the oil.

Table R-4-28 shows the Btu's mined, the Btu's of external energy used, and the Btu's produced by site-specific projects. It is assumed that the conceptual

TABLE R-4-28

ENERGY EFFICIENCIES OF SITE-SPECIFIC PROJECTS

Project	INPUTS Trillion Btu's Mined + External = Total	OUTPUTS Trillion Btu's Produced	Percent Efficency
Enercor (Rainbow)	12.530 + 5.550 = 18.080	9.570	52.9
Magic Circle	111.400 + 41.744 = 153.140	65.260	42.6
Paraho	118.800 + 61.420 = 180.220	77.430	43.0
Syntana-Utah	121.400 + 71.810 = 193.210	108.600	56.2
Tosco	142.200 + 39.400 = 181.600	90.580	49.9
TOTAL	506.330 + 219.920 = 726.25	351.44	48.4

projects would have similar energy relationships. Additional information on how these values were determined is included in Appendix R-L.

A more detailed discussion of this subject can be found in the Energy Analysis Handbook for Preparation of Oil Shale Development Environmental Impact Statements (BLM 1982a).

R-4.A.14 EXISTING LAND USE PLANS

The implementation of the applicants' proposed site-specific projects would result in 122 miles of disturbance for linear facilities located outside of the right-of-way corridors designated in BLM Management Framework Plans, as summarized on Table R-4-29. The areas of disturbance lying outside the corridors (shown on Map R-A-4, located in Appendix R-A) are in direct conflict with the plans, which state all rights-of-way must be located within a designated corridor. In addition, three river crossings would lie within the half-mile wide protective zone designated along the White River by BLM Management Framework Plans (Table R-4-29).

There could be additional conflicts due to the applicants' conceptual projects and due to the interrelated projects. However, specific conflicts cannot be identified at this time, because project designs presently are not sufficiently developed. Their needs for linear rights-of-way when combined with those of the applicants' site-specifc projects could overload the designated rights-of-way corridors. This EIS will be used to help update and refine the Management Framework Plans for the region.

Presently the existing Uintah County zoning ordinance is not in conflict with the applicants' proposed projects. However, Uintah County is in the process of revising its existing zoning ordinance and is developing a land use plan. Future potential conflicts associated with the new land use plan are not known at this time.

It has been indicated by the Ute Tribe of the Uintah and Ouray Indian Reservation that a strong land use plan will be developed for the reservation in the near future. The plan may contain specific constraints regarding Indian right-of-way corridors and Indian-owned land outside the present reservation boundary. The plan, when developed, may have the potential to conflict with several rights-of-ways indentified by Tosco and Magic Circle.

R-4.A.15 RUPTURES AND SPILLS

A product pipeline rupture or some other type of shale or tar sand oil spill would be possible at any time, although not very probable. The U.S. Department of Transportation (1978) data show that pipeline spills from all causes have decreased from 1968 to 1976, even though the miles of pipeline have increased. Annual spill frequencies during this period decreased more than 50 percent, from 0.0037 to 0.0015 events per mile of pipeline. Continuation of this trend indicates a much lower frequency of events in the future. The decrease in frequency is due to retirement of older pipelines and

TABLE R-4-29

CONFLICTS WITH EXISTING LAND USE PLANS
High-level Scenario

Project and Components Involved[a]	Plan or Ordinance	Conflict
Enercor (Rainbow)		
Water pipeline (15 mi) Power transmission line (17.5 mi)	Bookcliffs Management Framework Plan	ROW lies outside designated corridor
Water pipeline (2 mi)	Bookcliffs Managment Framework Plan	ROW within protected zone along White River
Plant site and all components within Uintah County	Uintah County Zoning Ordinance	Potential conflicts with new zoning ordinance being developed
Magic Circle		
Product pipeline (2.5 mi) Water pipeline (2.5 mi)	Rainbow Management Framework Plan	ROW lies outside designated corridor
Product pipeline (7 mi)	Bonanza Management Framework Plan	ROW lies outside designated corridor
Plant site and all components within Uintah County	Uintah County Zoning Ordinance	Potential conflicts with new zoning ordinance being developed
Product pipeline (29 mi) Water pipeline (10 mi)	Ute Indian Tribe Land Use Plan	Potential conflicts with new plan being developed
Paraho		
Power transmission (1 mi)	Bonanza Management Framework Plan	ROW lies outside designated corridor
Plant site and all components within Uintah County	Uintah County Zoning Ordinance	Potential conflicts with new plan being developed.
Syntana-Utah		
Product pipeline (9.5 mi) Water pipeline (1 mi) Natural gas pipeline (9.5 mi)	Bonanza Management Framework Plan	ROW lies outside designated corridor

TABLE R-4-29 (Concluded)

CONFLICTS WITH EXISTING LAND USE PLANS
High-level Scenario

Project and Components Involved[a]	Plan or Ordinance	Conflict
Plant site and all components within Uintah County	Uintah County Zoning Ordinance	Potential conflicts with new plan being developed
Tosco		
Product pipeline (6 mi) Water pipeline (1 mi) Power transmission (2 mi)	Bookcliffs Management Framework Plan	ROW lies outside designated corridor
Product pipeline (0.5 mi) Power transmission line (0.5 mi) Water pipeline (0.5 mi)	Bookcliffs Management Framework Plan	ROW within protected zone along White River
Product pipeline (0.5 mi) Power transmission line (0.5 mi) Water pipeline (0.5 mi)	Bonanza Management Framework Plan	ROW within protected zone along the White River
Plant site and all component within Uintah County	Uintah County Zoning Ordinance	Potential conflicts with new zoning ordinance being developed
Access road (6.5 mi)	Ute Indian Tribe Land Use Plan	Potential conflicts with new plan being developed

NOTE: ROW = right-of-way; mi = miles.

Specific conflicts of the conceptual projects and interrelated projects cannot be identified, because project designs are not sufficiently developed at this time.

installation of new pipelines which feature modern technology. Spills resulting from defective pipe and corrosion, previously the most frequent cause of failure, have reduced significantly, while rupture by third party excavation, although reducing, has become the most frequent cause of failure.

Based on the 1976 annual spill frequency rate of 0.0015 events per mile of pipe, the probability of a pipeline rupture of each applicants' product pipeline(s) can be determined. These pipelines range in length from 3.5 miles for Paraho's proposed pipeline to 160 miles for Tosco's Salt Lake City alternative product pipeline. Thus, the spill frequencies would range from 0.0053 to 0.24 events per year, or 0.053 to 2.4 events per 10 years.

The volume of an oil spill is determined by the time elapsed between pipeline rupture and pump shutdown, throughput of the pipeline as determined by the diameter of the pipe and pumping pressure, size of break in the pipeline, and distance between block valves. A standard formula used to determine typical spill volumes (Beyer and Painter 1977) is:

> Qy = 3.6×10^{-6} x yearly throughput (MMB), where Qy=barrels spilled, and MMB=volume, in millions of barrels.

Using this formula to determine the spill volume of the applicants' product pipeline with the greatest throughput (Syntana-Utah's 57,000 barrels per day pipeline), gives a volume of 75 barrels spilled. Thus, 75 barrels would be a typical spill volume based on real-life experience.

However, the spill analysis presented here is not based on typical spill volumes, but rather on a worst-case situation so that worst-case impacts are analyzed. Worst-case spill volumes are calculated for the applicants' projects by assuming 5 minutes for confirmation of rupture and pump shut down; complete rupture of a pipeline with manually operated valves; and location of rupture maximum distance from plant site (and therefore greatest travel time to shut the manually operated valves). The volumes calculated for each site-specific project range from 1,800 to 5,500 barrels for a land spill. (Specific volumes for each project are identified in Section 1.D of the appropriate site-specific Chapter 1.) Volumes calculated for the conceptual projects are 1,700 barrels for the Enercor-Mono Power's P.R. Springs project; 4,250 barrels for the Geokinetics Agency Draw project (no pipeline is proposed for the Lofreco project); and 1,200 barrels for Sohio's project. Therefore, the land spill impact analysis that follows assumes a spill volume of 5,500 barrels, the maximum worst-case spill of the applicants' projects.

Worst-case volumes were also calculated for a river spill. All the assumptions listed above were used except that it was assumed that block valves were located on both sides of the river. The volumes calculated for the site-specific projects range from 1,000 to 1,790 barrels. Volumes calculated for the conceptual projects are 2,575 barrels (Green River) and 2,500 barrels (White River) for Geokinetics; and 670 barrels for Sohio. The product pipeline of the Enercor-Mono Power P.R. Springs Project would not cross a river. Therefore, the water spill impact analysis that follows assumes a spill volume of 2,575 barrels, the maximum worst-case spill of the applicants' proposed projects.

In the land and river spill impact analyses that follow, the location assumed for the worst-case spill volume varies by resource, depending on where the worst impacts to a particular resource would occur. The net result can be considered a "worst" worst-case analysis. When considering the analyses that follow, the reader should keep in mind the probability of a spill of any volume occurring and the difference between the spill volumes assumed in the analysis and maximum spill volume predicted by real-life experience, which were discussed at the beginning of this section.

Some resources would not experience significant impacts due to the worst-case land or water spills identified in this section. It is not anticipated that traffic flow would be interrupted for any significant period of time due to oil on a roadway or movement of cleanup equipment on the roads. No wilderness units would be affected, because none are located within an area that could be affected by a spill. There would be minimal impacts to air quality, because the short-term nature and rapid dispersion of any vaporization of hydrocarbons would preclude any long-term impacts.

Land Spill

As discussed earlier, the maximum worst-case spill volume calculated for a spill on land for the applicants' projects is 5,500 barrels. Typically, the cleanup procedure used for a land spill may include construction of a primitive road with a grader to obtain access to the spill area or reblading an old construction road; mechanical cleanup of a spill; removal of contaminated soil and vegetation; and disposal of contaminated material and absorptive substances, such as mats and booms. Disposal methods could include burning, burying, drying and natural degradation, or concentration and disposal.

In terms of vegetation, soils, and livestock grazing, the worst-case situation would involve a spill on flat land, where the areal extent of the damage would be greatest. If 5,500 barrels of oil spilled onto a relatively flat native range area, it could conceivably cover 8.7 acres of land. Assuming that in most areas the oil would infiltrate the soil through cracks and crevices, there would be little or no oil standing on the surface. Oil-covered plants within the entire area would not support growth until the oil-contaminated soil would be removed from the site and the substrate conditioned and reseeded. Cleanup could be completed within a matter of hours to days, depending upon the location of the spill. Under most conditions, cleanup equipment would be moved overland to the spill site. The impact from the equipment could be greater than the actual spill, should the spill be located any great distance from an established access road or trail.

Should all vegetation on 8.7 acres of land be killed or removed, the forage loss would be less than one AUM. This loss would not require any adjustment in livestock numbers or seasonal use.

In terms of wildlife, the worst-case land spill situation would involve a rupture of the proposed Magic Circle product pipeline within the marsh area of the Ouray National Wildlife Refuge. (Within 2 to 3 years the total number of

acres of marsh habitat will be increased (Troester 1982).) If the spill occurred during the waterfowl nesting season, virtually all production would be lost for that year, and in most cases, death of adult waterfowl species would also occur. Marsh-dwelling species such as muskrats, small shore birds mice, crayfish, and so forth would also suffer direct mortality from the effects of oil on their fur, feathers, or in their digestive systems. The long-term effects of a spill in this area would last for at least 1 year if the marsh were drained, allowed to dry, and then burned to get rid of residual oil. Complete recovery of the marsh habitat could take 3 years or longer depending upon the types of cleanup methods used.

Because of the potential effects on waterfowl and mule deer, hunting within the area could be eliminated for several years. In addition, nature study and observation opportunities in the marsh area would be changed until the marsh is restored to its original state. Until restoration is complete, the progressive recovery of the marsh could be observed; however the number and type of animal and plant species that could be observed would be different.

In terms of soil and cropland production, a worst-case land spill situation would involve a rupture of the proposed Magic Circle product pipeline near the irrigated cropland located outside Randlett. The spill could occur in an area of loamy soils with a 1 percent slope planted to small grains, 4 weeks after germination.

Due to surface roughness caused by planting operations and the viscosity of the oil, the extent of the oil spill is predicted to cover an area of 3 to 4 acres, ranging from 1 inch to puddles 4 inches deep. The oil is expected to stay mainly on the surface and saturate the upper 2 to 3 inches of loose surface soil. Cleanup operations would require removal of oil and oil-saturated soil over approximately 4 acres at an average of 3 inches deep.

This would amount to removal of 806 to 1,209 cubic yards of topsoil. The remaining scattered areas of oil-saturated soil would be plowed under with applications of manure. The edges of the area would require leveling to allow proper distribution of irrigation water.

Additional land and crop distribution associated with access to the spill area and cleanup operations would occur. The impact would be a loss of 2 to 3 inches of topsoil over a 3-acre area and a 1 year loss in crop production amounting to approximately 180 bushels of barley. Some crop production could be reduced slightly for a 1- to 2-year period. Implementation of appropriate reclamation measures would minimize the topsoil loss.

In terms of cultural resources, a worst-case situation would be a spill in an area of high site density. If a previously unidentified significant site should be within a spill area, it could be displaced or destroyed during cleanup procedures. This would be an irreversible and irretrievable commitment of cultural resources.

In terms of visual resources, a worst-case land spill situation would be a spill in an area that could be seen from a highly sensitive travel route or use area, or within a VRM Class II or III area. The primary visual impact

would be from the destroyed vegetation and would last until the new vegetation would blend with the surrounding area. This could take many years.

Unquantifiable secondary visual impacts could occur if care were not taken when containment and cleanup operations were undertaken. Since the location of a spill is unpredictable, it would be difficult to quantify what secondary impacts would result. Spill location variables would include such items as whether new access would be constructed, whether soil and vegetation would be collected and buried, burned, or left to natural degradation. If buried, more acreage may be disturbed over a longer period of time than if the oil were permitted to remain. The severity of the visual impact would depend on the revegetation rate and success, as well as visual sensitivity and scenic quality of the area in which it occured. Generally, it would be a long-term impact.

River Spill

As discussed earlier, the maximum worst-case spill volume calculated for a complete pipeline rupture at a river crossing, assuming manually operated block valves on either side of a river, is 2,575 barrels. For most resources, it was determined that the impacts would be similar for the White River and the Green River. Where there would be a difference for a particular resource, this is explained.

A river spill would not cause significant impacts to some additional resources not previously identified in the introduction to the Rupture and Spill section. These are cropland, livestock grazing, and cultural resources.

In the event of an oil spill in the White River, it is estimated from USGS records that the flow would be 331 cfs (half the average daily flow). Under these circumstances oil concentrates would be about 10,000 parts per million (ppm) immediately downstream from the spill site. These concentrations would decrease rapidly due to oil sticking to objects in the stream, plume dispersion, and mixing. Considering a velocity of 1 foot per second it would take about 38 hours for the contaminated water to reach the Green River. At this point the concentration would be less than 800 ppm. Upon entering the Green River it would rapidly dissipate to unknown concentrations.

An oil spill on the Green River would occur when the flow would be 3,149 cfs (half the average daily flow). Under these circumstances oil concentrates would be about 1,000 ppm immediately downstream from the oil spill site. This concentration would rapidly change due to mixing and likely would not be detectable as any more than an oil film at the Green River's confluence with the Colorado River.

The above cited concentrations of oil would only exist at the "front" of the oil plume. Due to this, some downstream water users could be inconvenienced by the presence of oily water. The extent and nature of further impacts to other resources are discussed below.

Oil suspended in the water would be deposited on the stems of stream-side vegetation and possibly cover the entire plant in areas where grasses grow near the edge of the water line. The result is that some grasses would be killed, but brush species would not be adversely affected. Acres adversely affected would be small because of limited vegetation exposure at the water line. In the event shallow pools would be located near the spill, these pools could be filled with oil. Plants would be killed from direct contact with the oil and from the cleanup process. Total vegetation killed or removed from production would be negligible and insignificant as compared to the total available along the river.

In terms of wildlife, a worst-case situation for the White River would be a spill in Section 9, T.15S R.23E., just downstream from the White River Dam site when the river is flowing about 331 cfs (half the average daily flow). Under these circumstances, the oil concentration would be about 10,000 ppm, immediately downstream from the rupture point, and could cause direct mortality to the Colorado squawfish (Ptychocheilus lucius), humpback chub (Gila cypha), and the bonytail chub (Gila elegans), which are federally listed endangered species. No Colorado squawfish spawning areas have been documented in the White River; however, a potential spawning site exists at river mile 34, which would be very close to the theoretical spill site (FWS 1982).

In general, the effects of an oil spill of this magnitude would involve smothering of macroinvertebrates in the river substrate, suffocation of eggs or larvae of endangered fish species, contamination of waterfowl and aquatic mammals, and coating of shoreline vegetation which may or may not be killed, depending upon the amount of plant coverage. These types of impacts would occur in a tapering sequence along the entire length of the White River from the point of the spill to its confluence with the Green River (a distance of about 25 miles).

In terms of wildlife, a worst-case situation for the Green River would be a spill in about Section 9, T.5S., R.20E., (in the Ouray National Wildlife Refuge) when the river is flowing about 3,149 cfs (half the average daily flow). Under these circumstances, the oil concentration is estimated to be about 1,000 ppm, immediately downstream from the rupture site. These concentrations would disperse rapidly, and there would be few adverse impacts. The spill could cause some mortality to waterbirds and mammals, some smothering of macroinvertebrates, and some coverage of shoreline plants primarily along the stems. These impacts would probably not be detectable more than 5 miles downstream.

In terms of recreation resources, a worst-case spill in the White River or Green River would be temporary and generally minimal. However, there would be some differences in the types of impacts that would occur. In the event of a spill in the White River, the natural, cultural, and recreational values as related to the identification of the White River as a potential candidate for inclusion into the National Wild and Scenic River program would not be permanently impaired. The oil that would adhere to the canyon river banks at the specific flow rate would dissipate within 11 months, due to subsequent higher spring flows. This would result in no long-term visual or sensory

impacts upon the quality of river running experiences. However, at least two spring runoffs likely would be necessary to flush any backwater eddies between the spill site and the confluence with the Green River, resulting in somewhat longer but still temporary sensory impacts upon the quality of river running, waterfowl and small game hunting, and fishing experiences.

In terms of recreation resources, impacts to the Green River as a result of an oil spill would be similar to those identified for the White River, with the following exceptions. Because of the meandering nature of the river, it would take 1 to 2 years (especially within backwater eddies) for oil on the banks to dissipate. Short-term impacts (1 to 2 years) likely would be significant and create high public controversy, since the oil could be noted within the boundary of the Ouray National Wildlife Refuge. Both consumptive (waterfowl and mule deer hunting and fishing) and nonconsumptive (nature study and sightseeing) forms of recreation along the Green River would be adversely affected by the sensory impacts of oil along the river banks.

In terms of visual resources, impacts of a worst-case river spill would be temporary. The oil would be dispersed very rapidly downstream. Oil that would accumulate along the shoreline and in streamside vegetation would not be visually evident after a few weeks, or at a maximum, after a high water period.

R-4.A.16 SAFETY AND HEALTH

Anticipating occupational and environmental health and safety hazards is an important consideration in the development of an oil shale industry. To bring attention to known hazards, and to point out potential ones, this section covers the health and safety hazards associated with oil shale operations, and the environmental risks if contaminated air and water are released. Some control and mitigation methods that could be applied to these risks are identified in Appendix R-I.

The discussion presented in this section is based on information included in <u>An Assessment of Oil Shale Technologies</u> (Office of Technology Assessment 1980).

Mining

The similarity of hard-rock mining to underground shale mining makes it possible to project likely occupational safety risks. During mining, accidents result from rock and roof falls, explosions and fires, bumps and falls, electrocution, heavy mining equipment, and vehicular traffic. Hard-rock mining is a high-risk occupation; fatalities are five times more frequent in the mining and quarrying industry than in manufacturing. The frequency of disabling injuries from underground mining (excluding the coal industry) is two and a half times higher than from manufacturing. Mining coal is even more dangerous.

The hazard of mine flooding is not unique to oil shale, nor would it be encountered in all oil shale mines. However, it could be severe in mines that are developed within ground water areas. While the mining zones would be dewatered before mining could begin, there could be flooding if the pumps failed.

While most hazards to oil shale miners would be similar to those experienced by hard-rock workers, some are unique to oil shale. The Geokinetics Lofreco and Agency Draw projects are planning to use modified in-situ processes in which part of the deposit is mined out and the remainder is then rubbled and burned underground. The high temperatures and fires involved in modified in-situ processes may expose miners to risks that are not experienced in other underground mining activities.

During oil shale mining, hazardous substances including silica dust would be generated by blasting and drilling. In addition, blasting, raw shale handling and disposal, and other activities at the mine site would produce fugitive dust. Silica-containing dusts are noteworthy because they have been the single greatest health hazard throughout the history of underground mining. Silica is highly toxic to alveolar macrophages - "scavenger" cells that move about on the inside of the lung and engulf and remove foreign particles that might damage the lung. Silicosis, "shalosis," and chronic bronchitis are among the diseases that may result from the inhalation of oil shale dust.

Although few studies have been undertaken on the direct association between oil shale mining in the United States and the incidence of lung disease, there are studies on the prevalence of lung disease in oil shale miners in Estonia (a republic of the Soviet Union). Estonia mined 25 million tons of oil shale in 1973, and has had oil shale operations for several decades. While the results of the Estonian studies are more intriguing than convincing, they do suggest an association between oil shale mining and pulmonary fibrosis - an increase in the amount of fibrous material in the lung. One study also indicated that chronic bronchitis was 2 to 2 1/2 times more prevalent in 189 Estonian oil shale miners than in a similarly aged control population.

Studies of occupational diseases among oil shale miners in the United States have been limited because relatively few people have worked in the industry. A study was undertaken involving miners from the oil shale research center at Anvil Points, Colorado, which has operated intermittently since 1946. Eighty-six workers were identified, but only 39 had been exposed to oil shale for one or more years. Those 39 were compared with 26 other workers from the facility (e.g., office workers, administrators) who had not been directly involved in the mining operations. Results showed a twofold higher incidence of pneumoconiosis in the oil-shale exposed population. However, the interpretation of these results is complicated by the fact that most of the oil shale miners had previously worked in uranium-vanadium mines or milling operations which are known to be causes of pneumoconiosis. Further evaluation of these populations was not performed because of the age of the workers, their varying levels of exposure, and their limited experience in oil shale mining.

A separate study of employees at the same facility between 1974 and 1978 found no adverse health effects. An examination of the death certificates of 167 oil shale workers undertaken by the National Institute for Occupational Safety and Health failed to reveal any association between oil shale exposure and respiratory diseases. Because of the limited number of workers studied, their relatively short exposures to oil shale mining, and in some cases their exposures to other kinds of mining, no firm conclusions can be drawn from these studies.

Another area of concern is the possible exposure to carcinogens (polycyclic aromatic hydrocarbons-PAHs) and trace elements that might be produced during mining. A mortality study by the National Institute for Occupational Safety and Health found that the percentage of oil shale workers who had died from colon and respiratory concerns was greater than the percentage in the white male population of Colorado and Utah. Whether oil shale exposure contributed to the higher incidence is unclear, and the rate was not higher than that of the white male population in the United States.

A cancer morbidity study undertaken by the Rocky Mountain Center for Occupational and Environmental Health found more abnormalities (cytological atypia) in the sputum and urine of oil shale miners than among controls, but no association was found between exposure and skin diseases. Animal studies undertaken to date have not demonstrated that oil shale dust is carcinogenic.

A third potential health hazard to oil shale miners is exposure to excessive noise levels, particularly in underground operations carried out in relatively confined spaces. Noise arises from numerous sources such as booster fans, pneumatic drills, blasting, conveyors, and mining machines. The Bureau of Mines studied 19 pieces of diesel-powered mining equipment and found only 2 had noise levels below the current standards (90 decibels), and one of these exceeded the standard in an underground environment. One study estimated that of the 37,000 workers employed in 650 metal and nonmetal mines, approximately 14,000 (38 percent) were exposed to diesel-powered equipment noise levels greater than the standard. Of these, 2,430 (17 percent) were overexposed on a time-weighted-average basis. Evidence indicates exposure to noise from a large number of mining machines would produce hearing loss if the exposures exceeded 8 hours per day. Higher short-term noise exposures may occur during blasting. High noise levels are a potential hazard not only to hearing, but to the cardiovascular and nervous systems, and pose a safety hazard.

Retorting and Refining

Potential hazards associated with the retorting and upgrading of shale oil include explosions, fire and heat, bumps and falls, electrocution, and handling hot liquids. However, the degree of risk for workers involved in the processing of oil shale and its derivatives would not be expected to be so high as in mining.

The processes involved in retorting and upgrading (materials handling, crushing, solids heating and cooling, waste disposal, and the handling of hot and hazardous liquids) are generally similar to those used in other operations

such as mineral processing (limestone calcining, roasting of taconite and copper ores, and leaching) and conventional petroleum refining. Although no comparative study has been undertaken, there are few unique features associated with retorting, upgrading, and refining that would justify expecting higher worker safety risks than those in similar industries.

Retorting oil shale at high temperatures forms PAH-containing carcinogens of which 3.4-benzo(a)pyrene (BaP) is the most studied. PAHs are a major potential health hazard for retorting and refining workers in the oil shale industry because of the carcinogenicity. The problems that might be encountered in oil shale refining are similar to those of conventional oil refineries, where liquid and gases are transported in airtight pipes under strict maintenance to detect and repair leaks.

Crude oil contains an enormous variety of potentially hazardous compounds. Even more are produced during refining. Work crews involved in inspection, repair, and maintenance are the most likely to be exposed to PAHs. Other hazardous substances found in crude oil include chlorine, sulfur, nitrogen, and heavy metals (vanadium, arsenic, nickel, and cobalt). Toxic contaminants evolved during the refining process include hydrogen sulfide, hydrogen chloride, hydrochloric acid, sulfur dioxide, sulfuric acid, methane, ethane, methanol, nitric acid, nitrogen oxides, mercaptans, carbon monoxide, and benzene.

Two Estonian studies have shown an association between oil shale processing and cancer. A study of 2,003 Estonian oil shale workers with a total of 21,495 person-years exposure during the period between 1959 and 1975 found a significant excess of skin cancer (five-fold for females and threefold for males). An unusually high incidence of stomach and lung cancer was found among persons in the rural areas of Estonia where the oil shale industry is located. There is no information on the working conditions in Estonian oil shale operations; nor are data available on the ambient concentrations of shale-derived pollutants in the vicinity of the plants. It is therefore impossible to relate the Estonian experience to problems that might be encountered in the United States.

Refining shale oil would be similar to other refining operations. Available epidemiological studies do not lead to clear-cut conclusions about relationships between working in refineries and cancer.

Societal Hazards

Air pollutants include particulates, gases, and trace-metal vapors. Particulates which contain absorbed PAH can be carcinogenic. The sulfur and nitrogen-containing emissions are respiratory irritants. Among the sulfur-containing pollutants, the effects of acid sulfates, sulfuric acid, and sulfur dioxide dissolved in aerosols are the best documented. All three are irritants and can make breathing difficult. In addition, some epidemiological evidence relates chronic bronchitis and respiratory diseases to sulfur dioxide

and to particulate concentrations in the air. Oxides of sulfur and nitrogen, transported from industrial areas, may cause acidic rainfall that may reduce the productivity of forest vegetation and kill fish by increasing the acidity of lakes and streams. Nitrogen oxides can react with hydrocarbons in the atmosphere to produce ozone, photochemical smog, and acid rain. Airborne ammonia may cause headaches, sore throats, eye irritations, coughing, and nausea in humans.

Among the trace elements that may be emitted, mercury, lead, cadmium, arsenic, and selenium are considered to be potential air and water pollutants. Arsenic is a carcinogen, which when inhaled or ingested in large amounts, may also cause peripheral vascular disease and neuropathy. Mercury is a special problem because its vapors can pollute the air and earth many miles from the plant site. It can also contaminate surface streams and ground water aquifers. It can enter the food chain through the actions of microorganisms and can also pose a risk of irreversible neurological damage to humans who eat fish that have been contaminated by mercury in streams.

Leachates from aboveground disposal areas and burned-out in-situ retorts also pose potential problems. PAHs, salts, and metals may dissolve in surface streams and ground water and infiltrate public drinking water supplies. Water-soluble salts in spent shale contain as much as 40 percent of the total benzene-soluble organic matter. All of these materials can be dissolved in water and dispersed through soils. The exact nature of the threat posed by these materials to human health is unknown since, for example, PAHs are found throughout nature. However, the PAH content of spent shale leachates (up to 100 to 1,000 times higher than is found in normal ground or surface water) is a matter for concern. Fluoride, if released in excessive amounts in contaminated water, may cause fluorosis (reduced bone strength and debilitation) and mottled tooth enamel.

The severity of these hazards would depend on many factors. Many of the risks could be very small if they are anticipated, and if appropriate control strategies are designed and followed. If caution is not employed, or if there are catastrophic failures in the control systems during or after plant operation, damage could be severe and long lasting.

Summary of Hazards and their Severity

The safety and health hazards that might be associated with oil shale mining, retorting, and refining are identified in Table R-4-30. They are ranked according to their known potential to cause injury or death. As shown, mining has the highest potential for accidents, due to risks from rockfalls, explosions, moving equipment, and general working conditions. There were two fatalities during the mining of over 2 million tons of shale and the production of over 500,000 bbl of shale oil. The accident rate has been one-fifth that for all mining, and much lower than that for coal mining. However, this record was achieved in small-scale experimental mines that employed, for the most part, experienced hard-rock miners. Whether safety risks will increase or decrease as mining activities are expanded cannot be predicted. Risks might increase as the work force expands to include inexperienced miners

TABLE R-4-30

SUMMARY OF OCCUPATIONAL HAZARDS ASSOCIATED WITH OIL SHALE DEVELOPMENT

Occupational Risks	Potential Effect	Mining	Retorting	Refining
Accidents	Injury or death	H	M	L
Fires and explosions	Injury or death	L	M	M
Noise	Hearing loss or neurological damage	H	M	L
Dust	Lung disease	H	M	L
Dust	Dermatitis	L	M	L
Chemical Exposure	Cancer	L	M	M
Chemical Exposure	Dermatitis	L	M	M
Chemical Exposure	Poisoning	M	M	M
Chemical Exposure	Irritant gases	M	M	M

Source: Office of Technology Assessment 1980.

Note: H = higher level of risk; M = medium level of risk; L = lower level of risk.

and as large, rapidly moving mining equipment is used. On the other hand, the large mines proposed for oil shale plants may reduce risks because of the additional room in which to maneuver machines.

Fires and explosions are also identified as a hazard in mining. Although no severe fires have occured to date, laboratory studies indicate that airborne shale dust can propagate a methane explosion. Methane has been found in low concentrations in some oil shale deposits, especially those in the saline zone of the Piceance Basin. Oil shale dust is, however, far less explosive than coal dust.

Dust is a major health hazard. Its effect on the respiratory system is well-known. Excessive noise is also a recognized hazard. Cancer from oil shale mining has not been identified as a major hazard. Although the carcinogenicity of oil shale dust and crude shale oil has been demonstrated by some investigators, insufficient information and the conflicting results of other studies prevent a determination of the severity of the risk. However, the incidence of diseases in other industries indicates that exposure to these materials could be hazardous. Workers' health would need to be carefully monitored if health damage is to be avoided, and prevention techniques improved, as the oil shale industry develops.

Retorting is regarded as having medium risks in all areas. This ranking primarily reflects the low level of knowledge about retorting and its health and safety effects. However, the large variety of substances that would be encountered in retorting (from raw shale dust to trace-element emissions) may pose as yet undetected health hazards. Of special concern is the possibility of carcinogens in shale oil and its derivatives. Possible interactions in modified in-situ operations could increase the level of risk.

Shale oil refining is regarded as posing no special hazards in many areas and only moderate risks in the others. This is because most of the problems that would be associated with shale oil processing would be similar to those experienced in conventional petroleum refining.

R-4.B LOW-LEVEL SCENARIO

The impacts described in this section would result from implementing the low-level production scenario described in Section R-1.B, Low-level Scenario. This scenario assumes a less than full production level for the applicants' proposed projects. In general, its implementation would require about 7,635 construction workers and about 10,255 operation workers (Table R-1-12). About 37,859 acres would be disturbed (Table R-1-14). The size of shale disposal areas, and for some projects, the mine, would be less than for the high-level scenario, because of the lower production levels. Consequently, the amount of land disturbance on state and private land where these facilities would be located would be less. Baseline conditions for the environment that would be affected by this level of regional development are discussed in Chapter R-3.

Cumulative impacts of this scenario were analyzed for the year when the applicants' combined construction work forces would peak (1985) and, where

significantly different impacts would result, for the year when the combined operation work forces would peak (1993). Because the projects' facilities and the land surface disturbance would be essentially the same as for full production, the impacts to the following resources would not be significantly different from those described for the high-level scenario in the sections indicated:

Visual Resources (Section R-4.A.11).
Paleontology (Section R-4.A.12).
Existing Land Use Plans (Section R-4.A.14).

R-4.B.1 SOCIOECONOMICS

As with the high-level scenario, the low-level direct work force data was incorporated into the UPED model to obtain total employment and population projections. The effects of interrelated project developments were also projected. The information presented in this section is summarized from the more detailed Socioeconomics Technical Report (State of Utah 1982b).

Effects to the Ute Indian Tribe would be similar to those discussed for the high-level situation with no appreciable differences in magnitude of impact.

Population and Employment

Under the low-level scenario, the total population increase from the applicants' proposed projects would be 22,080 in 1985. This total includes increases not only in the identified socioeconomic area of influence, but also in Daggett and Grand counties (Utah), and Mesa and Garfield counties (Colorado). When adding interrelated projects, the total increase is 27,094 in 1985. This total also includes the interrelated projects that do not affect the socioeconomic area of influence, but have an effect on other resources. The 1993 total population increase as a result of the applicants' proposals would be 14,905, and 44,487 when including interrelated projects.

Table R-4-31 lists population data for the low-level scenario within the identified socioeconomic area of influence. In 1985, the population increase as a result of the applicants' proposed projects would be 17,678. When adding interrelated projects, the population increase would be 19,818 in 1985. In 1993, the population increases would be 22,717 and 36,371, respectively. For instance, in 1985, increases over baseline would be 26.0 percent due to the applicants' proposals and 29.2 percent with interrelated projects. In 1993, the percent growth over baseline would be 34.4 percent. With interrelated projects, there would be a much greater effect on population growth, with a cumulative increase of 55.1 percent over baseline.

Uintah County would experience the majority of the population increases in the area of influence. Vernal would be the most affected community. Dinosaur would experience the greatest percentage increase over baseline.

TABLE R-4-31

POPULATION IMPACTS BY COUNTY AND COMMUNITY
Low-level Scenario

Area	1985 Baseline	1985 Applicant Increase People	1985 Applicant Increase %[a]	1985 Interrelated Project Increase[b]	1985 Cumulative Increase People	1985 Cumulative Increase %[a]	1995 Baseline	1995 Applicant Increase People	1995 Applicant Increase %[a]	1995 Interrelated Projects Increase[b]	1995 Cumulative Increase People	1995 Cumulative Increase %[a]
Duchesne County	17,778	3,768	21.2	+ 363	4,131	23.2	18,712	5,826	31.1	2,092	7,918	42.3
Roosevelt	5,416	2,237	41.3	+ 244	2,481	45.8	5,948	3,461	58.2	1,441	4,902	82.4
Myton	705	112	15.9	+ 12	124	17.6	775	173	22.3	72	245	31.6
Remainder of County	11,657	1,419	12.2	+ 107	1,526	13.1	11,989	2,192	18.3	579	2,771	23.1
Uintah County	25,730	13,100	50.9	+1,631	14,731	57.2	29,982	16,043	53.5	9,834	25,877	86.3
Vernal	9,291	4,955	53.3	+ 565	5,520	59.4	11,421	7,736	67.7	3,814	11,550	101.1
Ballard	775	133	17.2	+ 20	153	19.7	985	179	18.2	78	257	26.1
Remainder of County	15,664	8,012	51.1	+1,046	9,058	57.8	17,576	8,128	46.2	5,942	14,070	80.0
Colorado Area	24,355	810	3.3	+ 146	956	3.9	17,288	848	4.9	1,728	2,576	14.9
Rangely	3,193	454	14.2	+ 82	536	16.8	3,725	474	12.7	919	1,393	37.4
Dinosaur	501	356	71.1	+ 64	420	83.8	420	374	89.0	809	1,183	281.7
Area of Influence	67,863	17,678	26.0	+2,140	19,818	29.2	65,982	22,717	34.4	13,654	36,371	55.1

Source: Utah Process Economic and Demographic Model. Utah State Planning Coordinator's Office, March and May 1982.

[a]Includes projects presented in Appendix R-F.

[b]Includes Moffat and Rio Blanco counties.

Total employment in the area of influence would increase by 32.7 percent in 1985 as a result of the applicants' proposed projects (refer to Table R-4-32). With interrelated projects, the increase over baseline would be 36.4 percent. In 1993, increases would be 29.0 percent and 47.2 percent, respectively. Uintah County would have most of the employment increase. The Colorado area would have very little of the employment benefits, even though the area would incur sizeable population impacts.

Housing

Table R-4-33 shows the impacts to housing for the low-level scenario. Even under the low-level scenario, the area of influence is projected to have a substantial increase in housing demand, which would cause a significant housing shortage. Uintah County would have the largest increase in housing demand. Vernal would have the largest increase in community housing demand, though Dinosaur would have the greatest percentage increase in demand over baseline, reaching 240.1 percent.

Personal Income

Under the low-level scenario, the per capita personal income (PCPI) would increase for the area of influence. In 1985, PCPI would be $11,074 due to the applicants' proposed projects as compared to the projected baseline of $9,437 (both 1980 dollars). This is a 17.3 percent increase over baseline. With interrelated projects, the PCPI level would be $11,187.

For 1993, the PCPI would be $11,978 due to the applicants' proposals as compared to a baseline PCPI of $11,719. With interrelated projects, the PCPI would be $12,085.

The vast majority of personal income increase due to the applicants' proposals would be within Uintah County. In 1993, this share would be 70.6 percent. With interrelated projects, the percentage share would be 73.3 percent. The Colorado area would have very little of the personal income benefits, with only 4.6 percent of the total increases in the area of influence.

Personal income increases in the area of influence would be $306.9 million in 1985 and $287.2 million in 1993 (both 1980 dollars) due to the applicants' proposed projects. Such increases in income would increase local prices of consumer goods and services and also the costs of housing. This local price inflation would have a serious adverse impact to fixed income groups, such as retirees and those individuals who do not possess the skills required for the higher paying jobs. Native Americans, who make up the largest minority group, especially may be vulnerable to price inflation. The present, relatively low income levels for Indians is an indicator of their skill advantage compared to the remaining population. Unless an active minority hiring and training plan is adopted by the companies, this group could suffer adversities from the increased cost of living.

TABLE R-4-32

EMPLOYMENT IMPACTS BY COUNTY
Low-level Scenario

	Duchesne	Uintah	Colorado Area	Socioeconomics Area of Influence
1985				
Baseline	7,203	10,585	13,933	31,721
Applicants Increase	586	9,691	106	10,383
Interrelated Projects Increase[b]	72	1,105	20	1,117
Cumulative Impacts	655	10,769	126	11,577
Applicants % Impacts[c]	8.1	91.6	0.8	32.7
Cumulative % Impacts[d]	9.1	102.0	0.9	36.4
1993				
Baseline	7,057	11,895	15,273	34,225
Applicants Increase	1,148	4,641	146	9,935
Interrelated Projects Increase[b]	472	5,444	299	6,215
Cumulative Impacts	1,620	14,085	445	16,150
Applicants % Impacts[c]	16.3	72.6	1.0	29.0
Cumulative % Impacts[d]	22.9	84.4	2.9	47.2

Source: UPED model, Utah State Planning Coordinators' Office (March 1982).

[a]Includes Moffat and Rio Blanco counties.

[b]Includes projects presented in Appendix R-F.

[c]Percent of increase over baseline due only to the applicants' proposals.

[d]Percent of increase over baseline due to the applicants' proposals with interrelated projects.

TABLE R-4-33

HOUSING DEMAND
Low-level Scenario

Area	1985 Baseline	1985 Applicant Increase Households	1985 Applicant Increase %	1985 Interrelated Project Increase[a]	1985 Cumulative Increase Households	1985 Cumulative Increase %	1995 Baseline	1995 Applicant Increase Households	1995 Applicant Increase %	1995 Interrelated Projects Increase[a]	1995 Cumulative Increase Households	1995 Cumulative Increase %
Duchesne County	5,323	1,299	24.4	123	1,422	38.0	5,362	1,821	34.0	628	2,449	45.7
Roosevelt	1,622	771	47.5	83	854	52.6	1,714	1,018	59.4	433	1,451	84.7
Myton	201	39	19.4	4	43	21.4	212	51	24.1	22	73	34.4
Remainder of County	3,500	489	14.0	36	525	15.0	3,436	752	21.9	173	925	26.9
Uintah County	7,706	3,532	45.8	493	4,025	52.2	8,591	4,682	54.5	2,910	7,592	88.4
Vernal	3,087	1,709	55.4	192	1,901	61.6	3,660	2,275	62.1	1,145	3,420	93.4
Ballard	205	46	22.4	7	53	25.8	249	53	21.3	23	76	30.5
Remainder of County	4,414	1,777	40.3	294	2,071	46.9	4,682	2,354	50.3	1,742	4,096	87.5
Colorado Area[b]	8,536	280	3.3	50	330	3.9	9,563	250	2.6	519	769	8.0
Rangely	1,116	157	14.1	28	185	16.6	1,303	140	10.7	276	416	31.9
Dinosaur	176	123	69.9	22	145	82.4	147	110	74.8	243	353	240.1
Area of Influence	21,565	5,111	23.7	666	5,777	26.8	23,516	6,753	28.7	4,057	10,810	46.0

Source: Utah Process Economic and Demographic Model (UPED), State Planning Coordinators' Office, June 1982.

NOTE: Households is defined to be an individual, or related or unrelated individuals living together in a housing units.

[a]Includes projects presented in Appendix R-F.

[b]Includes Moffat and Rio Blanco counties.

Government Services and Facilities

Education

Significant increases in teachers and classrooms would be in demand in the area of influence under the low-level scenario. Uintah County would have the greatest impacts with a 30.0 percent increase over baseline in 1985 for both teachers and classrooms as a result of the applicants' proposed projects. In 1993, the percentage above baseline would be 42.1 percent. With interrelated projects, the 1993 increase would be 66.7 percent. Duchesne County would also be significantly affected, with increases in teachers and classrooms of 15.7 percent in 1985 and 24.4 percent over baseline in 1993 as a result of the applicants' proposals. With interrelated projects, increases would be 17.2 percent in 1985 and 32.7 percent in 1993. The maximum increase in the Colorado area would be in 1993 with interrelated projects. The classroom demand would be easily handled given the predicted large excess capacity.

Medical

Substantial increases in medical personnel and facilities for the area of influence would also be required under the low-level scenario. The demand for hospital beds would increase over baseline by 21.5 percent as a result of the applicants' proposed projects. With interrelated projects, the increase would be 24.4 percent. In 1993, the increases over baseline would be 30.3 percent and 47.4 percent, respectively. Substantial increases in demand for physicians and nurses also would occur. In 1993, 12 additional physicians and 37 additional nurses would be required as a result of the applicants' proposals. With interrelated projects, the demand would rise to an additional 20 physicians and 60 nurses. Since the projected baseline demand exceeds the present capacity of hospital beds, and physicians and nurses are currently in short supply, the additional demands translate into additional needs.

Mental Health

Increased demand for mental health personnel and facilities would occur in the the area of influence under the low-level scenario. Present facilities are minimal in the area and the additional demands from increased in-migrants resulting from the low-level scenario would expand this problem. In 1985, increased demand is expected to result from the applicants' proposed projects. There would be a demand for 1 additional psychiatrist and 3 additional social workers in the area of influence. In 1993, interrelated projects would produce a need for an additional psychiatrist. The social worker increase over baseline would be 6, 4 due to the applicants' proposals and 2 as a result of interrelated projects. The Colorado area is not expected to require additional mental health personnel or facilities under the low-level scenario.

Law Enforcement

In 1985, the area of influence would have an additional 14.6 percent increase in demand for police officers as a result of the applicants' proposed projects. In 1993, this increase would be 19.3 percent. With interrelated projects, the 1985 percentage would change very little, with a 16.5 percent increase. However, in 1993, the cumulative increase would be 33.3 percent over the baseline demand. Uintah County would experience the greatest increase. The Colorado area would experience much less of an impact with maximum increase in demand over baseline in 1993 of 9.1 percent (cumulative). Police car demands would also increase with a 1985 increase over baseline for the impact area of 19.2 percent due to the applicants' proposed projects. In 1993, this demand increase would be 17.2 percent. In 1993, the cumulative increase would be 31.0 percent. Uintah County would be the most affected. The Colorado area would have a 7.1 percent increase in demand in 1993 as a result of the applicants' proposals and interrelated projects.

Fire Protection

Additional fire equipment would be needed in the area of influence under the low-level scenario. The major impact would occur to Uintah County. In 1985, there would be a demand in Uintah County for 1 additional pumper, while in 1993 the demand would increase to approximately 2 as a result of the applicants' proposed projects. Duchesne County and the Colorado area would be able to handle the additional demand.

Sewer

The community of Vernal, located within the area of influence, would be most affected, with a 1985 increase over demand of 33.3 percent due to the applicants' proposed projects. With interrelated projects, the increased demand would be 59.4 percent over baseline. In 1993, the increase in demand would be 67.7 percent and 101.1 percent, respectively. Vernal would be able to handle these increases if the planned sewer system expansion is completed on schedule. The communities of Myton, Roosevelt, and Ballard would be able to handle any additional demands under the low-level scenario with their existing systems. The Colorado communities would also be able to handle any additional demands that would be produced by the low-level scenario.

Water

Vernal would be the most severely affected community with water connection increases by 53.3 percent over baseline in 1985 as a result of the applicants' proposed projects. In 1993, the demand over baseline would rise to 67.7 percent; with interrelated projects, the increase would be 101.1 percent. If the present water system is expanded as planned, the additional demands would be handled. Roosevelt, Ballard, and Myton would have to expand their existing systems. Roosevelt's and Myton's systems would have to be expanded slightly

in 1993 while Ballard would likely contract additional water supplies from the Uintah and Ouray Indian Reservation.

Fiscal

The same impacts to the fiscal qualities would occur with the low-level scenario but to a lesser degree than with the high-level scenario. Refer to the high-level scenario discussion, Section R-4.A.1, Socioeconomics.

Hunting, Fishing, and Nonconsumptive Expenditures

Based on information supplied by the Utah Division of Wildlife Resources, the estimated increases in expenditures from hunters in 1985 would be $1,840,118 (in 1980 dollars) as a result of the applicants' projects. In 1993, the estimate would be $2,250,883. Adding the interrelated projects, estimated expenditures would be $2,070,555 and $3,650,535, respectively.

For nonconsumptive uses of wildlife, the estimated expenditure increase would be $343,482 in 1985 as a result of the applicants' projects. In 1995, the number would be $420,656. Adding the interrelated projects, estimated expenditures would be $386,221 and $678,486, respectively.

Fishing-related expenditures would increase by $4,968,044 in 1985 due to the applicants' projects. By 1993, the increased expenditure over baseline would be $6,083,808. When including the interrelated projects, increases would be $5,586,804 and $9,813,334, respectively.

Though expenditures would increase, the overall usage of wildlife and removal of habitat could reduce the wildlife population to the extent that the number of persons involved in consumptive and nonconsumptive uses of wildlife would be reduced. This could, in turn, reduce potential economic benefits of wildlife in the long-term.

Agriculture

As discussed in more detail in Section R-4.B.6, Agriculture, the development of the applicants' projects would cause acreage now being used for crop production to be lost to urban development. This loss would have a moderate adverse effect to the local agricultural sector within the area of influence. Estimates of the total valuations of crop loss have been made. These are based on calculated acreage loss for specific crops and per unit valuations of each type of crop. Crop valuations were obtained from the Utah State Department of Agriculture. In 1985, the estimated crop loss due to the applicants' projects would be $1.1 million (in 1980 dollars). In 1993, the loss is estimated as $1.2 million. The greatest loss would be in the displacement of alfalfa hay production.

Adding interrelated projects to the impact analysis would increase 1985 losses to $1.3 million. In 1993, total losses would be $2.0 million. Again, the displacement of alfalfa hay production would be the largest specific crop loss.

Though agricultural land conversion would occur, the value of the land used formerly for agriculture would increase substantially. The ranchers and farmers would receive higher prices for the sale or lease of their properties.

Quality of Life

The local social effects associated with this level of production would be substantial. The consequences of the population growth levels would be similar to those described under the High-level Scenario (Section R-3.A). These effects would be less intense, immediate, and widespread, however. The differences would be in degree, not nature. The affected communities in Uintah and Duchesne counties would still face very severe growth managment and control problems and the social environments would be altered significantly over the next several decades as compared to conditions that would be expected without synfuels development.

Communities in Daggett and Grand counties (Utah), and Rangely (Colorado), would, relative to Uintah and Duchesne counties, be minimally affected.

Consequences on the Ute Indians would be very similar to those described under the High-level Scenario, in Section R-4.A.1, Socioeconomics.

R-4.B.2 AIR QUALITY

Sulfur Dioxide

Modeling analysis results are presented in Tables R-4-34, R-4-35, and R-4-36 for short-term and long-term sulfur dioxide impacts, comparing predicted ground-level concentrations to the PSD incremental limitations and NAAQS standards for protection of human health and welfare.

Sulfur dioxide impacts from the combined applicants' proposed projects would be minimal in the areas of special interest. The Uintah and Ouray Indian Reservation would receive the greatest increased concentrations, but even within that area, predicted concentrations would be well below the PSD increment, even if the more conservative higher values are considered. All predicted ground-level concentrations are well below the NAAQS, and no significant impacts to human health or welfare are expected.

When interrelated projects are are considered, predicted ground-level concentrations are still within both the PSD and NAAQS limitations, and no significant air quality impacts from sulfur dioxide would be expected to either human health and welfare. The Class I increment limitation could be

TABLE R-4-34

SUMMARY OF MAXIMUM 3-HOUR AVERAGE SO_2 CONCENTRATIONS (ug/m^3)
Low-level Scenario

	Increment Consumption Above Baseline			Total Ambient Concentrations Including Baseline	
	Applicants' Site-Specific and Conceptual Projects	Applicants' and Interrelated Projects	Baseline	Applicants' Site-Specific and Conceptual Projects	Applicants' and Interrelated Projects
Population Centers					
Vernal	2-15	2-19	5-45	7-60	7-64
Green River	0-3	0-7	0-4	0-7	0-11
Rangely	1-11	1-22	0-1	1-12	1-23
Meeker	1-4	6-56	2-16	3-20	8-72
Craig	0-2	1-13	20-196	20-198	21-209
Glenwood Springs	0-2	1-12	1-9	1-11	2-21
Rifle	0-3	1-13	2-19	2-22	3-32
Parachute	0-3	3-33	2-21	2-24	5-54
DeBeque	0-5	1-15	5-52	5-57	6-67
Grand Junction	0-5	1-15	60-607	60-612	61-622
Existing Class I Area and Other Areas of Special Concern					
Flat Tops Wilderness Area	0-4	4-45a	4-39	4-43	8-84
Mt. Zirkel Wilderness Area	0-2	1-12	0-3	0-5	1-15
Dinosaur National Monument	0-9	1-24	1-5	1-14	2-29
Colorado National Monument	0-3	1-13	32-318	32-321	33-331
Uintah and Ouray Indian Reservation	2-21	3-39	19-185	21-206	22-224
High Uintas Wilderness Area (proposed)	0-1	0-1	0-1	0-2	0-2
Class II Area Receptor with Maximum Impact from Direct Source Emission In Uintah Basin	14-140	15-155	1-10	15-150	16-165
Ambient Air Quality Standard or Prevention of Significant Deterioration Increment					
PSD Class I Increment 25	A	A	NA	NA	NA
PSD Class II Increment 512	A	A	NA	NA	NA
NAAQS 1,300	NA	NA	A	A	A

NOTE: SO_2=sulfur dioxide; PSD=Prevention of Significant Deterioration; NAAQS=National Ambient Air Quality Standard; A=Standard or increment is appli
NA= Standard or increment is not applicable.

[a]Indicates violation of applicable standard or increment.

[b]Indicates violation of increment if monument is redesignated Class I.

TABLE R-4-35

MAXIMUM 24-HOUR AVERAGE SO_2 CONCENTRATIONS (ug/m_3)
Low-level Scenario

	Increment Consumption Above Baseline			Total Ambient Concentrations Including Baseline	
	Applicants' Site-Specific and Conceptual Projects	Applicants' and Interrelated Projects	Baseline	Applicants' Site-Specific and Conceptual Projects	Applicants' and Interrelated Projects
<u>Population Centers</u>					
Vernal	0-2	0-2	1-6	1-8	1-8
Green River	0	0-1	0-1	0-1	0-2
Rangely	0-2	0-3	0-1	0-3	0-4
Meeker	0-1	1-16	1-5	1-6	2-21
Craig	0	0-2	3-28	3-28	3-30
Glenwood Springs	0	0-3	0-2	0-2	0-5
Rifle	0-1	0-4	0-3	0-4	0-7
Parachute	0-1	0-7	0-3	0-4	0-10
DeBeque	0-1	0-4	1-11	1-12	1-15
Grand Junction	0-1	0-4	8-82	8-83	8-86
<u>Existing Class I Area and Other Areas of Special Concern</u>					
Flat Tops Wilderness Area	0	1-6a	1-5	1-5	2-11
Mt Zirkel Wilderness Area	0	0-2	0-1	0-1	0-3
Dinosaur National Monument	0-1	0-2	1-5	1-6	1-7
Colorado National Monument	0-1	0-4	4-40	4-41	4-44
Uintah and Ouray Indian Reservation	0-3	0-7	2-23	2-26	2-30
High Uintas Wilderness Area (proposed)	0	0	0-1	0-1	0-1
<u>Class II Area Receptor with Maximum Impact from Direct Source Emission In Uintah Basin</u>	2-22	2-24	0-1	2-23	2-25
<u>Ambient Air Quality Standard or Prevention of Significant Deterioration Increment</u>					
PSD Class I Increment 5	A	A	NA	NA	NA
PSD Class II Increment 91	A	A	NA	NA	NA
NAAQS 365	NA	NA	A	A	A

NOTE: SO_2=sulfur dioxide; PSD=Prevention of Significant Deterioration; A=Standard or increment is applicable; NAAQS=National Ambient Air Quality Standard; NA= Standard or increment is not applicable.

[a]Indicates violation of applicable standard or increment.

[b]Indicates violation of increment if monument is redesignated Class I.

TABLE R-4-36

ANNUAL AVERAGE SO_2 CONCENTRATIONS (ug/m^3)
Low-level Scenario

	Increment Consumption Above Baseline			Total Ambient Concentrations Including Baseline	
	Applicants' Site-Specific and Conceptual Projects	Applicants' and Interrelated Projects	Baseline	Applicants' Site-Specific and Conceptual Projects	Applicants' and Interrelated Projects
Population Centers					
Vernal	0	0	0	0	0
Green River	0	0	0	0	0
Rangely	0	0	0	0	0
Meeker	0	0-1	0	0	0-1
Craig	0	0	0	0	0
Glenwood Springs	0	0	0	0	0
Rifle	0	0	0-1	0-1	0-1
Parachute	0	0	0-1	0-1	0-1
DeBeque	0	0	0-1	0-1	0-1
Grand Junction	0	0	0-9	0-9	0-9
Existing Class I Area and Other Areas of Special Concern					
Flat Tops Wilderness Area	0	0	0	0	0
Mt. Zirkel Wilderness Area	0	0	0	0	0
Dinosaur National Monument	0	0	0	0	0
Colorado National Monument	0	0	0-1	0-1	0-1
Uintah and Ouray Indian Reservation	0	0	0	0	0
High Uintas Wilderness Area (proposed)	0	0	0	0	0
Class II Area Receptor with Maximum Impact from Direct Source Emission In Uintah Basin	0-2	0-2	0-1	0-3	0-3
Ambient Air Quality Standard or Prevention of Significant Deterioration Increment					
PSD Class I Increment 2	A	A	NA	NA	NA
PSD Class II Increment 20	A	A	NA	NA	NA
NAAQS 80	NA	NA	A	A	A

NOTE: SO_2=sulfur dioxide; PSD=Prevention of Significant Deterioration; A=Standard or increment is applicable; NA= Standard or increment is not applicable; NAAQS=National Ambient Air Quality Standard.

[a]Indicates violation of applicable standard or increment.

[b]Indicates violation of increment if monument is redesignated Class I.

exceeded at Flat Tops if the more conservative upper concentration values are used. The predicted concentrations remain well within the NAAQS limitations and no significant impacts to human health or welfare would be expected.

Total Suspended Particulates

The results of the analysis are shown in Table R-4-37 and R-4-38 for the predicted 24-hour and annual time frames.

The impacts from total suspended particulates from combined applicants' proposed projects make up a small portion of the total particulates concentration and are not a significant impact. Emissions of total suspended particulates from population growth and related activity dominate the particulates estimates (Table R-4-39) and would be significant. The towns of Vernal and Rangely would exceed the short-term (24-hour) PSD increments and the areas of concern (Dinosaur National Monument and the Uintah and Ouray Indian Reservation) would exceed the Class II increments if the upper values are considered. The long-term (annual) impacts from secondary emissions in these areas could also be exceeded if the more conservative upper values are used.

All secondary emissions that were predicted to result from population growth and related activities associated with the applicants' proposed projects (including such things as vehicle travel on unpaved roads) were included in the PSD increment comparison. The objective was to compare the predicted impact with the PSD incremental allowance as a measure of significance and could not be used in a regulatory sense. Not all of these emissions would necessarily be considered by EPA to consume increment. The detailed assessment of the actual increment availability and subsequent increment use by any of the applicants' proposed projects would be made by the State of Utah or EPA, as appropriate, during the PSD permit regulatory process.

The predicted total suspended particulates ground-level concentrations would exceed both the short-term and long-term NAAQS in many areas due to secondary emissions as summarized in Tables R-4-37 and R-4-38. Total suspended particulates impacts from the applicants' proposed projects and related activities would occur primarily in Vernal, Rangely, Dinosaur, and the Uintah and Ouray Indian Reservation. Predicted background concentrations in each of these areas are already high, and the added impact of the proposed developments would increase these levels.

As shown in Table R-4-39, secondary total suspended particulates from area source emissions (principally emissions from unpaved roads) would dominate the cumulative impact of the applicants' projects plus the interrelated projects. Impacts in many areas would be greater than the ambient air quality standards.

Other air quality impacts, including impacts from nitrogren dioxide, carbon monoxide, and ozone would be insignificant. Impacts from other pollutants discussed for the high-level scenario would be reduced roughly in proportion to the reduction in emissions at the lower production level.

TABLE R-4-37

MAXIMUM 24-HOUR AVERAGE TSP CONCENTRATIONS (ug/m^3)
Low-level Scenario

	Increment Consumption Above Baseline			Total Ambient Concentrations Including Baseline	
	Applicants' Site-Specific and Conceptual Projects	Applicants' and Interrelated Projects	Baseline	Applicants' Site-Specific and Conceptual Projects	Applicants' and Interrelated Projects
Population Centers					
Vernal	60a-244a	120a-485a	185a-740a	245a-984a	305a- 1,225a
Green River	3-13	4-17	38-150a	41-163a	42-167a
Rangely	91a-365a	241a-970a	135-540a	226a-905a	376a-1,510a
Meeker	0-1	142a-579a	110-440a	110-441a	252a-1,019a
Craig	0-1	11-54a	190a-760a	190a-761a	201a-814a
Glenwood Springs	0	30-123a	110-450a	110-450a	140-573a
Rifle	0-1	61a-247a	300a-1,200a	300a-1,201a	361a-1,447a
Parachute	0	80a-324a	235a-940a	235a-940a	315a-1,264a
DeBeque	0-1	40a-165a	120-480a	120-481a	160a-645a
Grand Junction	0-2	70a-286a	310a-1,200a	310a-1,202a	380a-1,486a
Existing Class I Area and Other Areas of Special Concern					
Flat Tops Wilderness Area	0-1	15a-70a	75-300a	75-301a	90-370a
Mt. Zirkel Wilderness Area	0	6-28a	30-110	30-110	36-138
Dinosaur National Monument	21-84a	41a-167a	100-400a	121-484a	141-567a
Colorado National Monument	0-2	15b-66a	80-320a	80-322a	95-386a
Uintah and Ouray Indian Reservation	55a-312a	90a-456a	125-500a	180a-812a	215a-956a
High Uintas Wilderness Ares (proposed)	0-1	0-1	25-110	25-111	25-111
Class II Area Receptor with Maximum Impact from Direct Source Emission In Uintah Basin	53a-312a	90a-456a	125-500a	180a-812a	215a-956a
Ambient Air Quality Standard or Prevention of Significant Deterioration Increment					
PSD Class I Increment 10	A	A	NA	NA	NA
PSD Class II Increment 37	A	A	NA	NA	NA
NAAQS 150/260	NA	NA	A	A	A

NOTE: SO_2=sulfur dioxide; PSD=Prevention of Significant Deterioration; A=Standard or increment is applicable; NA= Standard or increment is not applicable; NAAQS=National Ambient Air Quality Standard.

[a]Indicates violation of applicable standard or increment.

[b]Indicates violation of increment if monument is redesignated Class I.

TABLE R-4-38

ANNUAL AVERAGE TSP CONCENTRATIONS (ug/m3)
Low-level Scenario

	Increment Consumption Above Baseline			Total Ambient Concentrations Including Baseline	
	Applicants' Site-Specific and Conceptual Projects	Applicants' and Interrelated Projects	Baseline	Applicants' Site-Specific and Conceptual Projects	Applicants' and Interrelated Projects
Population Centers					
Vernal	13-52a	28a-112a	45-180a	58-232a	73a-292a
Green River	0-1	1-3	10-40	10-41	11-43
Rangely	15-61a	55a-221a	30-120a	45-181a	85a-241a
Meeker	0	31a-125a	30-120a	30-120a	61a-245a
Craig	0	3-13	45-180a	45-180a	48-192a
Glenwood Springs	0	4-16	30-120a	30-120a	34-136a
Rifle	0	15-61a	70a-280a	70a-280a	85a-341a
Parachute	0	20a-81a	55a-220a	55-220a	75a-301a
DeBeque	0	8-33	30-120a	30-120a	38-153a
Grand Junction	0	20a-81a	70a-280a	70a-280a	90a-361a
Existing Class I Area and Other Areas of Special Concern					
Flat Tops Wilderness Area	0	3-11a	20-80	20-80a	23-91a
Mt. Zirkel Wilderness Area	0	1-4	10-40	10-40	11-44
Dinosaur National Monument	6b-24a	11b-44a	25-100a	31-124a	36-144a
Colorado National Monument	0	4-17b	20-80a	20-80a	24-97a
Uintah and Ouray Indian Reservation	8-35a	14-59a	35-140a	43-175a	49-199a
High Uintas Wilderness Area (proposed)	0	0	10-40	10-40	10-40
Class II Area Receptor with Maximum Impact from Direct Source Emission In Uintah Basin	6-34a	11-54a	28-110	34-144a	39-164a
Ambient Air Quality Standard or Prevention of Significant Deterioration Increment					
PSD Class I Increment 5	A	A	NA	NA	NA
PSD Class II Increment 19	A	A	NA	NA	NA
NAAQS 60/75	NA	NA	A	A	A

NOTE: SO_2=sulfur dioxide; PSD=Prevention of Significant Deterioration; A=Standard or increment is applicable; NA= Standard or increment is not applicable; NAAQS=National Ambient Air Quality Standard.

[a]Indicates violation of applicable standard or increment.

[b]Indicates violation of increment if monument is redesignated Class I.

TABLE R-4-39

SUMMARY OF PRIMARY AND SECONDARY MAXIMUM 24-HOUR AVERAGE TSP CONCENTRATIONS (ug/m^3)
Low-Level Scenario

	Applicants' Site-Specific Projects		Applicants' Conceptual Projects		Interrelated Projects Uintah Basin		Interrelated Projects Piceance Basin	
	Direct	Secondary	Direct	Secondary	Direct	Secondary	Direct	Secondary
Population Centers								
Vernal	0-1	40a-160a	0-3	20-80a	0-1	60a-240a	0	0
Green River	0	2-8	0-1	1-4	0	1-4	0	0
Rangely	1-5	60a-240a	0	30-120a	0-2	30-120a	0-3	120a-480a
Meeker	0-1	0	0	0	0-1	0	2-17	140a-560a
Craig	0	0	0-1	0	0	0	1-13	10-40a
Glenwood Springs	0	0	0	0	0	0	0-3	30-120a
Rifle	0-1	0	0	0	0	0	1-6	60a-240a
Parachute	0	0	0	0	0	0	0-4	80a-320a
DeBeque	0-1	0	0	0	0	0	0-4	40a-160a
Grand Junction	0-1	0	0-1	0	0	0	0-4	70a-280a
Existing Class I Area and Other Areas of Special Concern								
Flat Tops Wilderness Area	0	0	0-1	0	0	0	2-17a	13a-52a
Mt. Zirkel Wilderness Area	0	0	0	0	0	0	0-4	6-24a
Dinosaur National Monument	0-1	15b-60a	0-3	5-20b	0-1	20b-80a	0-2	0
Colorado National Monument	0-1	0	0-1	0	0	0	0-4	15b-60a
Uintah and Ouray Indian Reservation	2-21	30-120a	13-131a	10-40a	0-2	35-140a	0-2	0
High Uintas Wilderness Area (proposed)	0-1	0	0	0	0	0	0	0
Class II Area Receptor with Maximum Impact from Direct Source Emission In Uintah Basin	2-21	30-120a	13-131a	10-40	0-2	35-140a	0-2	0
Ambient Air Quality Standard or Prevention of Significant Deterioration Increment								
PSD Class I Increment 10	A	A	A	A	A	A	A	A
PSD Class II Increment 37	A	A	A	NA	NA	A	NA	A
NAAQS 150/260	NA	NA	NA	NA	NA	NA	NA	NA

NOTE: SO_2=sulfur dioxide; PSD=Prevention of Significant Deterioration; NAAQS=National Ambient Air Quality Standard; A=Standard or increment is applicable; NA= Standard or increment is not applicable.

[a]Indicates violation of applicable standard or increment.

[b]Indicates violation of increment if monument is redesignated Class I.

Visibility Impairment

The low-level scenario values are not significantly different than those predicted for the high-level scenario, and impacts would be similar to those discussed for the high-level scenario (Section R-4.A.2, Air Quality).

Table R-4-40 shows the predicted visual range reduction from the contributions of each source and the total visual-range reduction. Total visual range reduction looking from Flat Tops toward the northwest horizon sky from the cumulative effects of the applicants' proposed projects and interrelated projects would be 7.24 percent. Most of the reduction would result from sulfate aerosol formed by the sulfur dioxide emission. Little of the reduction would be due to the secondary emissions associated with population growth.

R-4.B.3 WATER RESOURCES

Based upon the water use figures that were submitted by the applicants (Table R-1-15), this level of production was not modeled on the computer. Amounts of water that would be used do not significantly differ from those in the high-level of production; therefore, reductions in flow and increases in salinity would not be significantly different than with the high level of production.

R-4.B.4 VEGETATION, SOILS, AND RECLAMATION

Low-level production would result in a disturbance of 30,369 acres by the applicants. Construction of roads, pipelines, buildings, power transmission lines, and support facilities would result in the same amount of disturbance under both scenarios. The reduced mining and spent shale disposal activity under the low-level scenario would determine the difference in land disturbance between the two scenarios. The acres of each vegetation type that would be affected are shown on Table R-4-41. Because of the small difference in total acres disturbed (6,542 acres), the impacts for the low-level scenario would be essentially the same as for the high-level scenario (Section R-4.A.4, Vegetation, Soils, and Reclamation). They are considered to be insignificant.

R-4.B.5 WILDLIFE

Impacts to wildlife species under the low-level scenario are not expected to be significantly different from those described for the high-level scenario (Section R-4.A.5, Wildlife). No additional endangered fish species' habitat would be affected, so impacts would remain essentially the same. The estimated population growth would have about the same indirect wildlife impacts (poaching, harassment, wanton killing, and habitat removal for housing development) as under the high-level scenario.

TABLE R-4-40

WORST-CASE REDUCTION OF VISUAL RANGE FOR A VIEW FROM FLAT TOPS WILDERNESS AREA LOOKING TOWARD THE NORTHWEST
Low-level Scenario

Source	Year 1980 Baseline	Low-Level Scenario
Uinta Basin oil shale and tar sand	0.00	0.95
Other Uinta Basin point sources	0.45	1.56
Piceance Basin oil shale	0.00	0.99
Other Piceance Basin point sources	1.96	2.95
Uintah County area sources[a]		
5 um aerosol	0.04	0.08
10 um aerosol	0.17	0.36
Rio Blanco County area sources[a]		
5 um aerosol	0.03	0.03
10 um aerosol	0.15	0.15
Moffat County area sources[a]		
5 um aerosol	0.01	0.03
10 um aerosol	0.05	0.14
Total visual range reduction	2.86	7.24

[a]Only particulate emissions from unpaved roads, which are more than 90 percent of total particulate emissions, were considered in the visibility analysis.

TABLE R-4-41

REGIONAL VEGETATION TYPES AND DISTURBANCE
Low-level Scenario

		DISTURBANCE			
		By Applicants' Projects[a]		By Applicants Projects Plus Interrelated Projects	
Vegetation Type	Acres in Area of Influence	(Acres)	(% of Type)	(Acres)	(% of Type)
Riparian	6,150	100	1.6	100	1.6
Mixed-desert shrub	1,843,200	15,084	0.8	28,416	1.5
Pinyon-juniper	483,840	10,512	2.1	10,904	2.2
Upland-brush	322,560	1,871	0.5	3,987	1.2
Sage-grass	161,280	2,555	1.5	2,555	1.5
Bookcliffs woodland	230,400	247	0.1	247	0.1
TOTAL	3,047,430	30,369	1.0	46,209	1.5

NA = Not Applicable

[a]Acres of riparian vegetation disturbed by interrelated projects is unknown.

R-4.B.6 AGRICULTURE

Cropland

The low-level scenario would differ from the high-level scenario in the amount of cropland removed from production and crop production loss caused by the applicants' proposed projects. Refer to Table R-4-42 for the amount of cropland removed from production and crop production losses predicted for implementation of the low-level scenario. The cumulative impact of the applicants' proposed projects and other interrelated projects would result in a 12 percent crop production loss to the region (State of Utah 1981) and would have a moderate effect on the agricultural sector of the economy (Section R-4.B.1, Socioeconomics).

Grazing

The low-level production impacts to livestock would result from the disturbance of 30,369 acres. The impacts of this loss would be essentially the same as described for the high-level scenario (Section R-4.A.6, Agriculture). Under the low-level scenario, an average of 818 fewer acres per project or 54 fewer AUMs per year would be disturbed, which would result in an impact of 11 animals per year per project less than under the high-level scenario. The cumulative loss of AUMs under the low-level scenario would be 2,024 AUMs per year. The loss of livestock forage would occur primarily on state land. Forage losses that cause reductions in livestock numbers would not be considered significant (Wall 1981).

The potential loss of grazing due to disturbance from the predicted increase in recreation activities (ORV travel) would be less under this scenario than for the high-level scenario due to a smaller population increase. However, the amount of impact cannot be quantified at this time, because the increased amount of recreation activity cannot be specified with present levels of knowledge.

R-4.B.7 TRANSPORTATION NETWORKS

For the low-level scenario, significant increases in vehicle traffic would be expected. The projected use and levels of service for specific roads shown in Tables R-4-43 and R-4-44. In 1985, several roadway segments at U.S. 40 (Utah) would drop from acceptable levels of service to unacceptable levels as a result of the increased traffic from the applicants' developments. The U.S. 40 segment from the Colorado line to SR 264 would be reduced from a baseline level of C to F. Also, the U.S. 40 segment from Vernal to Jensen would be severely affected, decreasing from C to E. All other road segments in the analysis area would remain acceptable, though most would have level of service reductions. When adding interrelated projects, level of service impacts are the same as for just the applicants' projects, except for U.S. 40 (Utah) between SR 88 and Vernal. This segment would drop from a baseline level of C to E.

TABLE R-4-42

CUMULATIVE PREDICTED ANNUAL CROPLAND AND CROP PRODUCTION LOSS
Low-level Scenario

			Principal Crop Production Loss[a]				
Project Scenario	Year	Cropland Lost (Acres)	Alfalfa Hay (Tons)	Meadow Hay (Tons)	Oat (Bushels)	Barley (Bushels)	Corn (Silage) (Tons)
Applicants' Proposed Projects	1985	4,858	12,316	1,224	17,751	21,243	3,686
	1995	5,410	13,716	1,363	19,825	23,725	4,104
Applicants' Projects With Interrelated Projects	1985	5,537	14,036	1,395	20,252	24,236	4,119
	1995	8,690	22,027	2,191	31,781	38,033	6,612

[a]Crop production loss figures are for the principle crops grown on 95 percent of the cropland with the following crop distribution: alfalfa hay, 65 percent; meadow hay, 14 percent; oats, 6 percent; barley, 6 percent; and corn for silage, 4 percent.

TABLE R-4-43

PROJECTED AVERAGE ANNUAL DAILY TRAFFIC
DUE TO APPLICANTS' PROPOSED PROJECTS
Low-level Scenario

Highway Link	Number of Vehicles 1985	1995	Level of Service[a] 1985	1995
U.S. 40				
County Line to County Road 264	9,212	11,435	F	F
County Road 264 to SR 88	6,728	8,286	D	E
SR 88 to Vernal	7,624	9,397	D	F
Vernal to Jensen	7,168	9,553	E	F
Jensen to SR 45	3,238	4,236	C	C
SR 45 to Utah/Colorado Border	3,051	3,951	C	C
Interstate 70				
SR 163 to Utah/Colorado Border	4,175	6,169	A	A
SR 88				
U.S. 40 to County Road 264	3,773	4,752	C	D
County Road 264 to Ouray	3,828	4,819	C	D
New Road "C"	1,189	1,574	A	A
SR 45				
Northern	540	519	A	A
Southern	556	519	A	A
New Road "D"	1,070	325	A	A
Colorado 64				
Dinosaur to Rangely	5,706	7,567	C	D
New Road "A"				
Vernal to SR 45	2,516	1,775	B	A

Source: State of Utah 1982.

[a]American Association of State Highway and Transportation Officials (1965) Levels of Service. A = free traffic flow, accompanied by low volumes and high speeds; B = stable traffic flow, with operating speeds beginning to be restricted by traffic conditions; C = stable traffic flow, but drivers are restricted in their freedom to select speed, change lanes, or pass; D = approaches unstable traffic flow, with fluctuations in volume and temporary restrictions to flow, which may cause substantial drops in operating speeds; E = unstable traffic flow, with momentary stoppages; F = forced traffic flow, with low speeds and short or long stoppages because of downstream congestion.

TABLE R-4-44

PROJECTED AVERAGE ANNUAL DAILY TRAFFIC
DUE TO APPLICANTS' PROPOSED PROJECTS AND INTERRELATED PROJECTS
Low-level Scenario

Highway Link	Number of Vehicles 1985	1995	Level of Service[a] 1985	1995
U.S. 40				
County Line to County Road 264	9,564	14,403	F	F
County Road 264 to SR 88	7,125	10,606	D	F
SR 88 to Vernal	8.106	12,207	E	F
Vernal to Jensen	7,406	11,401	E	F
Jensen to SR 45	3,355	5,076	C	D
SR 45 to Utah/Colorado Border	3,193	4,892	C	D
Interstate 70				
SR 163 to Utah/Colorado Border	28,875	30,869	C	C/D
SR 88				
U.S. 40 to County Road 264	3,773	4,752	C	D
County Road 264 to Ouray	3,828	4,819	C	D
New Road "C"	1,189	1,574	A	A
SR 45				
Northern	660	846	A	A
Southern	676	864	A	A
New Road "D"	1,709	4,088	A	B
Colorado 64				
Dinosaur to Rangely	5,920	9,153	C	E
New Road "A"				
Vernal to SR 45	3,202	5,382	B	C

Source: State of Utah 1982.

[a]American Association of State Highway and Transportation Officials (1965) Levels of Service. A = free traffic flow, accompanied by low volumes and high speeds; B = stable traffic flow, with operating speeds beginning to be restricted by traffic conditions; C = stable traffic flow, but drivers are restricted in their freedom to select speed, change lanes, or pass; D = approaches unstable traffic flow, with fluctuations in volume and temporary restrictions to flow, which may cause substantial drops in operating speeds; E = unstable traffic flow, with momentary stoppages; F = forced traffic flow, with low speeds and short or long stoppages because of downstream congestion.

In 1993, baseline levels of service remain acceptable except for the U.S. 40 (Utah) segments between the Colorado line and SR 264 and between Vernal and Jensen. These segments drop to Level D under the baseline. With the applicants' project, levels of service in most segments within analysis area drop to unacceptable levels. The most affected segments would be U.S. 40 from SR 264 to Vernal and SR 88 from U.S. 40 (Utah) to Ouray.

The U.S. 40 (Utah) segment between SR 264 to SR 88 would drop from a baseline level of C to E as a result of the applicants' projects. The U.S. 40 segment (Utah) from SR 88 to Vernal would drop from level C to F. Both SR 88 segments would decrease from baseline levels of A to D. Including interrelated projects would decrease the levels of service even more on several of the roadway segments. U.S. 40 (Utah) segments between Jensen and the Colorado line and I-70 (Utah) have unacceptable levels of service.

Since key segments of major roads are presently near design service capacity, increases in traffic even to the low-level scenario would generate need for selective upgrading and added maintenance in order to provide acceptable transportation conditions. Information on volume-to-capacity and level of service is discussed in more detail in the Socioeconomics Technical Report (State of Utah 1982b).

R-4.B.8 RECREATION

The applicants' proposed projects and the interrelated projects would disturb 46,089 acres of the land base for outdoor recreation use over the life of the projects. However, as analyzed in Section R-4.A.8, Recreation, there would be greater impacts to recreation by the increased number of persons recreating in the region. The impacts under this low-level scenario would generally be the same as analyzed in Section R-4.A.8, Recreation, but would occur to a lesser degree. The severity of impacts to hunting, fishing, hiking, ORV use, and other dispersed recreation opportunities during the peak construction year (1985), would be approximately 25 percent less, since cumulative population growth within the eight county area of influence (Uintah, Duchesne, Daggett, and Grand counties, Utah; Rio Blanco, Moffat, Garfield, and Mesa counties, Colorado) would be 27,094 people, or 25 percent less than the high-level scenario. Visitation to parks, the refuge, and forests within the region would also be approximately one quarter less under this scenario.

However, by 1993, the peak operation year, the cumulative regional population growth due to the applicants' proposed projects and interrelated projects would be 44,487 people. This predicted increase above normal baseline growth would have severe adverse impacts to hunting, fishing, hiking, ORV use and other forms of dispersed recreation opportunities, but to a lesser degree than the 72,857 population growth in 1995 under the high-level scenario. In fact, impacts to recreational experiences would be 64 percent less severe than analyzed in Section R-4.B.8, Recreation. Nevertheless, increased user pressure would still adversely affect the quality of recreational experiences.

Deficiencies in meeting demands for municipal and county recreation facilities also would be expected under this scenario (refer to Section R-4.A.8, Recreation). In 1985, the peak construction year, population growth due to the cumulative regional projects would be virtually similar to the high-level scenario, resulting in overcrowding and declining user satisfaction at existing facilities and local and county park areas in Vernal and Roosevelt, Utah, and Rangely, Colorado. During the peak operation year, 1993, there would be approximately 30 to 40 percent less people residing in Vernal and Roosevelt, Utah, and Rangely, Colorado, than was analyzed in Section R-4.A.8, Recreation. However, deficiencies in municipal and county recreation opportunities would still exist.

R-4.B.9 WILDERNESS

The same direct and indirect adverse environmental consequences caused by the Enercor-Mono Power P.R. Springs project would result to the Winter Ridge area and the Westwater Canyon WSA as analyzed for the high-level scenario (Section R-4.A.9).

The temporary influx in the eight county area of influence of 22,080 people by 1985 (peak construction) and permanent influx of 24,593 by 1993 (peak operation) would result in an increase in visits to the wilderness units within the area of influence (Table R-3-15). Both population increases (1985 and 1993) would have similar effects upon the wilderness resource base and wilderness values, because there would be no significant difference between the projected population increases.

However, when adding the projected population growth of the interrelated projects to the applicants' proposed projects, the amount of predicted visitation to wilderness units would be expected to increase between the peak construction and peak operation years. During the peak construction year of 1985, a cumulative regional population growth of 27,094 people would be predicted. During the peak operation year of 1993, a cumulative regional population growth of 44,487 people would be anticipated. Therefore, the most severe impacts to the wilderness resource base under this scenario would occur when peak operation is reached.

As analyzed in the high-level scenario (Section R-4.A.9), significant adverse impacts to wilderness values (primarily solitude and naturalness) would first occur on those wilderness units currently of greatest popularity (Flat Tops Wilderness Area; proposed High Uintas Wilderness Area; Desolation Canyon and Westwater Canyon WSAs; Arches National Park; and Colorado and Dinosaur National Monuments).

R-4.B.10 CULTURAL RESOURCES

Under the low-level scenario, impacts to cultural resources would be the same as described for the high-level scenario (Section R-4.A.10). However, they would be less intense, because fewer acres would be disturbed and the population increase would be less.

TRENDS HAVING SIGNIFICANT IMPACTS, IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES AND BENEFITS AND TRADE-OFFS

This chapter provides a perspective on the effects of implementing all the applicants' proposed projects on the long-term use of man's environment. Of special concern are new trends that would be established, short- and long-term benefits and trade-offs, and irreversible and irretrievable commitments of resources. In this context, "short-term" refers to the construction period and the subsequent 3 to 5 years required for reclamation of construction disturbance. "Long-term" refers to an estimated 35-year maximum project life. Numbers used in the discussion of trends, commitments, and trade-offs represent the high-level scenario.

R-5.A TRENDS HAVING SIGNIFICANT IMPACTS

Development of the proposed synfuels projects at a commercial level would further advance the synfuels technology in the United States. Additionally, it would fully establish a trend for continuing oil shale and tar sand resource use in the Uintah Basin. A successful and maturing synfuels industry in the Uintah Basin could be established by the projects as described here. This could result eventually in future expansion of production by these initial projects, development of additional oil shale reserves located in the Uintah Basin, and/or extension of the life of currently planned projects.

R-5.B IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

Implementation of the projects would result in commitments to use the area more intensively and would significantly alter the use of various resources. The use and consumption of land and resources would be irreversible (once initiated, use and impacts would continue and could not be reversed for a long time, if at all) or irretrievable (irrecoverable for a long period of time or permanently). Some commitments are both irreversible and irretrievable. Should a decision be made to authorize the proposed projects, some resources would be committed for the short-term until certain renewable resources could be re-established; other resources would be committed for the long-term, after which resources would return to prior use or conditions.

SOCIOECONOMICS

A decision to allow the proposed projects to be developed would encourage the development of certain social-spatial patterns. These, in turn, would call for commitment of additional lands to support the increased population, thereby locking people into an expanding social system that in many ways would be irreversible. The commitment to use the oil shale resources in the proposed manner would result in intensifying and probably solidifying a new way of life and lifestyle for the Uintah Basin area.

AIR QUALITY

Although a renewable resource, air quality and visibility would be reduced during the life of the projects. This change would not be irreversible; however, the reduction in air quality during the project life would be irretrievable, particularly to the Dinosaur and Colorado National Monuments, and on the Uintah and Ouray Indian Reservation.

WATER RESOURCES

The 2,863 acre-feet per year of water that would be required during the construction phase of the projects would be lost to other uses, including agriculture, recreation and wildlife. Operation the proposed projects would consume an estimated 40,870 acre-feet of water per year. Over a 35-year maximum period this, would result in the consumption of about 466,113 million gallons of water that could otherwise be available for other uses. As all of the projects are designed to be nondischarging, this amount of water would be totally consumed in the process. In addition to this amount, water would also be required to support the projected increased total population of 151,739 people by 1995. Some of the water required by the population increases would be returned to the system after treatment.

LOST PRODUCTION

Current production on the project areas is primarily forage and browse utilized by domestic livestock and wildlife. Project implementation would result in an irreversible loss of livestock and wildlife forage on a least 7,339 acres covered by man-made structures. Irretrievable losses of livestock grazing would amount to 2,169 animal unit months (AUMs) annually or a total of about 76,000 AUMs during the projected 35-year project life, from land removed from production during project life. Forage production on approximately 29,572 acres that would be disturbed during construction and subsequently reclaimed would be reduced until reclamation returns the area to current production levels. This could take upwards of 40 to 50 years. The amount of this loss cannot be quantified. Population increase would result in the loss of an estimated 14,930 acres of cropland which would be converted to urban uses. This would likely be a irretrievable loss. Wildlife habitat production on an undeterminable acreage would be-irretrievably lost due to increased human utilization.

RECREATION AND WILDERNESS

The approximate increase of two and one-half times the number of people in the area and the increased recreational use resulting from this population would cause irreversible impacts on the recreation resource. Recreation use, (hunting, fishing, off-road vehicle use, and similar activities) would be intensified. This increase would affect existing nearby National forests, national parks and monuments, wilderness and primitive areas. The semi-primitive experience of river running on portions of the White River, and to a

lesser extent the Green River, would be irretriveably lessened during the life of the projects as a result of placement of facilities along and across the rivers. A portion of these rivers, studied and recommended by the National Park Service for additional study for possible inclusion into the Wild and Scenic River System would be affected by the proposed projects. This could result in an irretrievable and irreversible commitment to non-Wild and Scenic River status; however this situation can only be resolved by Congress when and if it acts on the recommendation.

The Winter Ridge roadless area would be affected. The recommendation that this area not be included as a wilderness study area is being appealed. Until this appeal is settled and/or the area studied for its wilderness suitability, it cannot be stated wether the proposed projects would impair the areas' wilderness characteristics or result in an irreversible and irretrievable commitment of resources.

CULTURAL RESOURCES AND PALEONTOLOGY

Implementation of the proposed projects would involve an irretrievable commitment of paleontological and archaeological values to exploration and investigation under current technical procedures. Once destroyed, these values would not be available for future study. Salvage sites could not be studied with more advanced technological methods that might be developed in the future. Increased population levels would exert additional pressure on these resources, resulting in overuse and destruction. The total number of sites that could be affected is unknown.

VISUAL RESOURCES

Implementation of the proposed action would irreversibly and irretrievably commit the area to a more intensive, industrialized use than at present. The essentially natural landscape would be altered on approximately 36,911 acres by intrusion of roads, buildings, transmission lines and people. Although many of these disturbed acres would be reclaimed, the alterations would irreversibly change the quality of the visual environment. The natural, open views of unaltered landscape would be changed for as long as proposed facilities and the effects of environmental damage would exist, which could be until well after project abandonment.

MINERAL RESOURCES

The major commitment of resources would be about 4,112 million tons of oil shale and 513 million tons of tar sand over the projected 35-year project life. Of the oil shale total about 2,467 million tons would be mined and utilized in shale oil production. The remaining 1,645 million tons would be left in place for safety and other reasons and would likely not be recoverable at a later date unless modified in-situ techniques are perfected. The total commitment of oil shale resources represents about 0.5 percent of known reserves in the Uintah Basin area.

The large amounts of sand, gravel and other types of aggregrate material (for such things as the new town, access roads, plant facilities) that would be used would be irretrievable for all practical purposes, because replacement under prevailing natural conditions could take centuries.

There is a possibility that other minerals found in association with oil shale or tar sand would be irretrievably lost.

R-5.C **BENEFITS AND TRADE-OFFS**

This section briefly discusses productivity of the socioeconomic and natural environments that would be affected by the construction and operation of the proposed synfuels projects. Productivity can be viewed two different ways: (1) in terms of economic growth, as may be associated with synfuels development, or (2) in terms of the natural (or renewable resource) capacity of the land. Economic productivity may tend to be highly variable and influenced by national (and worldwide) conditions, which would strongly influence the financial viability of the proposed projects. Natural productivity would be primarily in the Uintah Basin. Project specific decisions and interaction (trade-offs) involving both forms of productivity would continue throughout the 35-year maximum project life. Beyond 35 years, structures would probably continue to affect natural productivity, since the major roads and power transmission lines likely would remain due to established regional use patterns. It is assumed that other aboveground, synfuels processing facilities would be removed and partially salvaged and the affected areas reclaimed.

Table R-5-1 presents an overview of the benefits and trade-offs that could be associated with the proposed projects. Direct quantification of the trade-offs is not possible for all resources. A review of Table R-5-1 shows the items and resources that would benefit (in general, those showning increases in quality or quantity) and those that would be exchanged (those showing decreases) to achieve the benefits.

TABLE R-5-1

BENEFITS AND TRADE-OFFS

Resource/Item	Quality or Quantity Increase	Decrease
Oil/Energy Production	X	
Oil Shale/Tar Sand Reserves		X
Employment Opportunities	X	
Income Levels	X	
Local Prices and Wages	X	
Service Infrastructure Needs and Costs	X[a]	
Quality of Life	X[a]	X[b]
Air Quality/Visibility		X
PSD Available Increments		X
Water Quality (salinity, acidic deposition		X
and other pollution potential)		X
Vegetative Production		X
Wildlife Populations		X
Agriculture		X
Traffic and Transportation	X[a]	
Road Quality		X
Outdoor Recreation		X
Wilderness		X
Cultural Resources		X
Visual Resources		X
Paleontological Resources		X

[a]May not be viewed as a benefit by some people.

[b]May not be viewed as a negative trade-off by some people.

SITE-SPECIFIC ANALYSES INTRODUCTION

This is the second part of the Uintah Basin Synfuels Development EIS. This part covers the five site-specific projects: Enercor Rainbow; Magic Circle Cottonwood Wash; Paraho-Ute; Syntana-Utah; and Tosco Sand Wash. These projects require federal rights-of-way within the next two to three years in order to be developed.

A separate site-specific impact analysis has been prepared for each of the five projects. Each of these is, in effect, an EIS covering the topics that the CEQ regulations require. The major difference between these analyses and a typical EIS is that each project is analyzed as if none of the other projects proposed for construction by applicants included in this EIS would occur. This approach allows the various federal, state, and local decision makers to assess the effects of each project as if it would be the only one to occur. Therefore if economic conditions force a change in the applicants' plans and schedules of development, this EIS would still be useful in reaching the required decisions pertinent to a particular project. The regional part of this EIS looks at the combined cumulative impact of all the proposed synfuel projects.

The impact analyses for the site-specific projects consider a 1-mile wide corridor for all linear facilities. This is because none of the routes have been surveyed and staked. The routes shown on all the maps included in this EIS represent the centerline of the 1-mile wide analysis corridor.

Several techniques were used to avoid duplication of data and reduce the size of the EIS. This introduction presents data on topics that apply to all or most of the site-specific projects: project need, authorizing actions, and descriptions of general oil shale mining, processing and upgrading techniques. In addition, information in the regional cumulative analysis is referenced where appropriate, rather than repeated in a site-specific analysis, and rather than including highly detailed project descriptions, the applicants' technical reports are incorporated by reference.

Throughout the discussions of the site-specific projects, the term project area is frequently used. This term refers to the lease area and all rights-of-way required for the proposed action, as described in the appropriate Section 1.D, Proposed Action.

NEED FOR PROJECT

The need for each proposed project is similar in nature and related to the national demand for petroleum products and the national goal to reduce dependence on foreign oil sources. In recent years, domestic production of petroleum products has not kept pace with domestic demand. The Energy Information Administration 1980 Annual Report to Congress shows the supply and demand have been increasing, but that the imports rather than the domestic supply have been making up the difference (Table SS-1). Mid-range projections for 1985, 1990, and 1995 show that domestic demand will drop from the 1978

TABLE SS-1

SUMMARY OF PETROLEUM SUPPLY/DEMAND BALANCE
(Million Barrels per Day)

	History			Mid-Range Projections		
	1965	1973	1978	1985	1990	1995
Domestic Supply	9.2	11.3	10.9	9.7	9.9	10.9
Shale, Tar Sand and Synthetics	0	0	0	0	0.2	0.5
Net Imports	2.2	6.1	8.0	5.4	5.3	3.6
Total Supply	11.4	17.4	18.0	15.1	15.2	14.5
Total Domestic Demand	11.5	17.3	18.9	15.2	15.4	14.6
Percent of Total Supply which is Shale, Tar Sand and Synthetics	0	0	0	0	1.32%	3.45%

Source: Energy Information Administration. 1980 Annual Report to Congress, Volume 3, Forecasts, Table 3.19 Petroleum Supply/Demand Balance: History and Projections for Three Base Scenarios, 1965-95.

level, as will imports and total supply. Imports will remain at almost 25 percent of demand by 1995. As in the past, demand usually will be slightly greater than production.

The projections show an increase in synfuels oil production from zero in 1985 to 0.5 million barrels per day (mmbpd) in 1995. The 0.2 mmbpd projected for 1990 represents 1.32 percent of the total projected supply, and the 0.5 mmbpd projected for 1995 represents 3.45 percent of the total projected supply for that year. This projected increase is a small but important factor in balancing the supply level with the demand. However, crude oil would still make up the major percentage of the total supply.

The combined full production capacity of the five site-specific synfuel projects assessed in this EIS would be approximately 180,500 barrels per stream day (bpsd) by 1991 (Table R-1-4). This would be a substantial portion, 36 percent, of the mid-range domestic synthetic production estimate for 1995.

Development of any of the proposed projects would contribute to the maturation of the synfuels industry through application of present technology at a commercial scale.

NO-ACTION ALTERNATIVE

The No-Action Alternative is considered for each of the site-specific projects. This alternative would constitute BLM denial of the right-of-way applications for a particular synfuel developer to use federal lands for the proposed project. It could remain in effect for a short time or a long, indefinite period.

Under the No-Action Alternative, no change from current management direction or level of management intensity would occur, and the current level of development and patterns of management would be maintained, especially as related to BLM-administered land in the affected area. No major permanent facilities for these projects would be built on BLM land for synfuels development at this time. This would result in a continuation of existing trends in the area including major planned projects other than the applicants' proposed projects.

The No-Action Alternative would be intended to avoid major commitments of resources at this time so that conflicts between energy needs and environmental values could be further studied. It would be intended to accommodate further definition (or firming up) of actual energy demands as synfuels technology develops, as well as additional definition of possible interrelated projects in the Uintah Basin. It would be intended to preserve present options available in resource management and decision-making.

Chapter R-3 describes the existing environment of the Uintah Basin. The intent would be to maintain the present environmental status under the No-Action Alternative.

SITE-SPECIFIC ANALYSES INTRODUCTION

The No-Action Alternative is required in this EIS in accordance with regulations of the Council on Environmental Quality and the National Environmental Policy Act. It is a valid alternative to be considered in the decision-making process.

Details concerning the No-Action Alternative for a particular site-specific project are discussed in the appropriate site-specific Chapter 1 and Chapter 4.

AUTHORIZING ACTIONS

The federal, state, and local actions that would be required to implement any of the applicants' proposed synfuel projects would generally be the same regardless of the type of project or its location. These actions are listed in Tables SS-2 through SS-4 (federal actions, state actions, local actions). As a part of the process of issuing the various required authorizations, the agencies require compliance with standard procedures to mitigate potential impacts. These are identified in Appendix SS-A, General Measures. Since these procedures would be required regardless of the designs of the proposed projects, they were considered in the analysis of the impacts for each of the proposed site-specific projects.

GENERAL OIL SHALE MINING, PROCESSING, AND UPGRADING TECHNIQUES

This section discusses, in general terms, mining, processing, and upgrading techniques that would be used for a typical oil shale development. It does not necessarily describe accurately the actual approach that would be used for any individual applicant's project, but provides useful background for the layperson. Section 1.D.2 of each site-specific Chapter 1 discusses more specific details pertinent to an individual project. Complete descriptions of the techniques that would be used are included in each applicant's project description technical report.

Oil shale is a common earth resource found on all continents. The greatest deposits are found in Asia. Compared with many other oil shale deposits in the world, the oil shale deposits in the Green River Formation are small in terms of area, but they are rich.

The Green River oil shale resource was deposited about 50 million years ago in what were then 2 large lakes. Over 10 million years ago, trillions of aquatic organisms settled into the mineral silt on the lake bottoms, piling up in thick beds. After the lakes disappeared, the rich organic and mineral mixtures were covered by new deposits, and the combination of pressure, heat, and time solidified the minerals into dolomitic limestone, sometimes called marlstone. This is what is commonly referred to as oil shale.

Still sandwiched between the limestone layers are the 50-million-year-old remains of prehistoric organisms, pressed into a rubbery, energy-rich resource known as kerogen. It is this substance which, when heated to about 900

TABLE SS-2

MAJOR FEDERAL AUTHORIZING ACTIONS

Agency	Nature of Action	Authority	Project Feature (Applicable Project)[1]
DEPARTMENT OF THE INTERIOR			
Bureau of Land Management	Grant rights-of-way	Title V of Federal Land Policy and Management Act of 1976, 43 U.S.C. Sections 1761-1771; CFR Part 28; and Section 28 of the Mineral Leasing Act, 30 U.S.C. Section 185; 43 CFR Part 2880	Corridor facilities; access roads, power transmission line water supply pipeline, ore conveyors, underground mining tunnels, communication lines
	Grant rights-of-way on BLM, F&WS and FS land	Section 28 of the Mineral Leasing Act of 1920, 30 U.S.C. Section 185; 43 CFR Part 2880	Oil pipelines
	Issue leases and permits	Section 302 of Federal Land Policy and Management Act of 1976; 43 U.S.C. Section 1732	Facilities (other project components) not related to rights-of-way
	Issue temporary use permits	Title V of Federal Land Policy and Management Act: Section 28 of the Mineral Leasing Act of 1920	Temporary construction activities
National Park Service	Issue antiquities or archaeological resource permit to excavate or remove archaeological resources on Public Lands	Antiquities Act of 1906, 16 U.S.C. Sections 431-433; Archaeological Resources Protection Act of 1979, 16 U.S.C. Sections 470aa-470ll; 43 CFR Part 3	Access roads, power transmission lines, communication lines, water supply pipeline, and ore conveyor on public lands
Bureau of Indian Affairs (Uintah and Ouray Agency)	Grant rights-of-way to cross Indian lands	25 U.S.C. Sections 323-328; 25 CFR Part 161	Access roads, power transmission lines, water supply pipeline (M,T) product pipeline (T)
U.S. Fish and Wildlife Service (Ouray National Wildlife Refuge)	Concur in right-of-way crossing National Wildlife Refuge Land	Section 28 of the Mineral Leasing Act of 1920, 30 U.S.C. Section 185; 50 CFR Section 29.21	Shale oil pipeline (T)[1]
	Review impact on threatened or endangered species of fish, wildlife, or plants	Section 7 of Endangered Species Act of 1973, 16 U.S.C. Section 1536; 50 CFR Part 402	All
ENVIRONMENTAL PROTECTION AGENCY	Receive and approve spill prevention control and countermeasure plan	Section 311 of Federal Water Pollution Control Act Amendments of 1972, 33 U.S.C. Section 1321; 40 CFR Part 112	Intermediate and product storage tanks
	Issue Resource Conservation and Recovery Permit for treatment, storage, or disposal of hazardous waste	Section 3005 of Resource Conservation and Recovery Act of 1976 42 U.S.C. Section 6925; 40 CFR Parts 122, 124, 260-267	Hazardous waste disposal
	Register generators of hazardous waste	Section 3002 of Resource Conservation and Recovery Act of 1976, 42 U.S.C. Section 6922; 40 CFR Parts 122, 262	Hazardous waste generation
	Issue a nondischarging National Pollutant Discharge Elimination System Permit	Section 402 of Federal Water Pollution Control Act Amendments of 1972, as amended; 33 U.S.C. Section 1342; 40 CFR Parts 122, 123, 124, and 125	Water ponds and treatment plants
	Issue permit for reinjection of mine water	Part C of Safe Drinking Water Act, 42 U.S.C. Sections 300h to 300h-3; 40 CFR Parts 122, 124, 146	Underground injection wells. (The Utah Department of Health, Division of Environmental Health, Bureau of Water Pollution Control has applied for primacy under the UIC program. Once primacy is attained, this permit will not be required.)
	Permit manufacture of shale oil	Section 3 of Toxic Substances Control Act, 15 U.S.C. Section 2604	Shale oil retorts

TABLE SS-2 (Concluded)

MAJOR FEDERAL AUTHORIZING ACTIONS

Agency	Nature of Action	Authority	Project Feature (Applicable Project)[1]
DEPARTMENT OF TRANSPORTATION			
Federal Aviation Administration	Issue air space permit for airport-related air space determination and air space obstruction clearance for project facilities	Section 1101 of the Federal Aviation Act of 1958, 49 U.S.C. Section 1501; 14 CFR Part 77	Stacks at plant site and other facilities
Federal Highway Administration	Issue permit(s) to cross Federal-aid highways	23 U.S.C. Sections 116, 123, 315; 23 CFR Part 645 Subpart B	Water pipelines, ore conveyor, access roads, etc.
Research and Special Programs Administration Office of Operations and Enforcement	Regulate safe construction and operation of pipelines	18 U.S.C. Section 834; 49 U.S.C. Section 1655; 49 CFR Part 195	Pipelines (M,P,S,T[2])
DEPARTMENT OF AGRICULTURE			
U.S. Forest Service (Uinta and Wasatch-Cache National Forests)	Concur in right-of-way grant for crossing National Forest System Land	Section 28 of the Mineral Leasing Act of 1920, 30 U.S.C. Section 185; 43 CFR Part 2880; 36 CFR Part 251	Shale oil pipeline (T[2])
	Issue permit for borrow materials	Materials Act, 30 U.S.C. Sections 601, 602; 30 CFR Section 251.4	Construction materials for shale oil pipeline (T[2])
	Issue special use permit for constructing rights-of-way and facilities	Title V, of the Federal Land Policy and Management Act of 1976, 43 U.S.C. Sections 1761-1771; Section 28 of the Mineral Leasing Act, 30 U.S.C. Section 185	Construction of shale oil pipeline (including access roads, field offices, and staging areas) (T[2])
	Issue antiquities or archaeological resource permit to excavate and remove archaeological resources on National Forest System lands	Antiquities Act of 1906, 16 U.S.C. Sections 431-433; Archaeological Resources Protection Act of 1979, 16 U.S.C. Sections 470aa-470ll; 43 CFR Part 3	Construction of shale oil pipeline (including access roads, fields offices, and staging areas) (T[2])
DEPARTMENT OF THE ARMY			
U.S. Army Corps of Engineers	Issue (Section 404) permit for placement of dredged or fill material in waters of the United States or their adjacent wetlands	Section 404 of the Federal Water Pollution Control Act Amendments of 1972, 33 U.S.C. Section 1344; 33 CFR Parts 323, 325	River or stream crossings for access roads, water supply pipeline, product pipelines, etc.
	Issue permit (Section 10) for structures or work in or affecting navigable waters of the U.S.	Section 10 of the River and Harbor Act of 1899, 33 U.S.C. Section 403; 33 CFR Parts 320-322, 329	Water diversion facilities, dams, wells, and construction resulting in alterations to water course
DEPARTMENT OF THE TREASURY			
Bureau of Alcohol, Tobacco, and Firearms	Issue permit(s) to purchase, store, and use explosives	Section 1102(a) of Organized Crime Control Act of 1970, 18 U.S.C. Sections 841-848; 27 CFR Part 181	Transport and use of explosives
DEPARTMENT OF LABOR			
Mine Safety and Health Administration	Approve mine safety plans and facilities	Federal Mine Safety and Health Act of 1977, 30 U.S.C. Sections 801 et. seq.; 30 CFR Chapter I.	Mining and crushing facilities
Occupational Safety and Health Administration	Inspect surface construction for worker safety	Occupational Safety and Health Act of 1970, 29 U.S.C. Sections 651 et. seq.; 29 CFR Part 2200	Construction of processing surface facilities (Federal role limited to assiting and auditing Utah Industrial Commissions enforcement of state OSHA plan)
FEDERAL COMMUNICATIONS COMMISSION	License to operate industrial radio service	Section 303 of Communications Act of 1934, 47 U.S.C. Section 303; 47 CFR Parts 90, 94	Communications
DEPARTMENT OF ENERGY			
Economic Regulatory Administration	Grant exemption from requirement that new major fuel-burning installations be designated to burn coal	Energy Supply and Environmental Coordination Act of 1974, 15 U.S.C. Sections 791-798; 10 CFR Parts 303-305	A "major fuel-burning installation" includes any boiler, burner, or other combustion or any combination thereof, at a single site which burns fossil fuels

E=Enercor-Mono Power; M=Magic Circle; P=Paraho; S=Syntana-Utah; and T=Tosco.

[1]Unless specified, the authorizing actions apply to all of the proposed projects.
[2]Applies only to Tosco Salt Lake City Alternative Product Pipeline.

TABLE SS-3

MAJOR STATE AUTHORIZING ACTIONS

Agency	Nature of Action	Authority	Project Feature (Applicable Project)[1]
UTAH DEPARTMENT OF NATURAL RESOURCES AND ENERGY			
Division of State Lands	Grant rights-of-way	Utah Code Annotated Section 65-2-1 (1978)	Corridor facilities; access roads, power transmission line, water supply pipeline, ore conveyors, shale oil pipeline, communication lines
	Issue special use permits for State Forest land	Utah Code Annotated Section 65-2-1 (1978)	Corridor facilities; access roads, power transmission line, water supply pipeline, ore conveyors (E)
	Approve state mineral leases	Utah Code Annotated Section 65-1-18 (1978); Utah Rules and Regulations Governing the Issuance of Mineral Leases	Mines
Division of Water Rights	Well drill r's permit	Utah Code Annotated Section 73-5-25 (1981)	Water wells
	Permits to construct diversion facilities or change place or nature of use of an existing water right	Utah Code Annotated Section 73-3-3 (1981)	Water diversion facilities
	Certificate to appropriate water	Utah Code Annotated Section 73-3-1 to 29 (1981)	Use of previously unappropriated water
	Approve plans and specifications for construction or repair of dams	Utah Code Annotated Section 73-3-5 (1981)	Construction of any impoundment dam
	Approval of plan to alter natural stream	Utah Code Annotated Section 73-3-29 (1981)	Alteration of a natural stream
Division of Forestry and Fire Control	Burning permit during closed fire season	Utah Code Annotated Section 24-2-12 (1976)	Burning of slash and waste
Division of Oil, Gas, and Mining	Issue Notice of Intention to Commence Exploratory Drilling; Notice of Intention to Commence Mining	Utah Code Annotated Section 40-8-13,(Supp. 1981); Rule M-3, Board of Oil, Gas, and Mining Form MR-1	Exploratory drilling and coring; mining operation and reclamation
UTAH DEPARTMENT OF DEVELOPMENT SERVICES			
Division of State History	Issue permit to survey or disturb archaeological or paleontological site on state land	Utah Code Annotated Section 63-18-25 (1978)	All
	Review impact on historical or cultural sites on or eligible for National Register of Historic Places	Section 106 of National Historical Preservation Act of 1966, 16 U.S.C. Section 470f; 36 CFR Part 800	All
UTAH DEPARTMENT OF TRANSPORTATION	Issue encroachment permits	Utah Code Annotated Section 27-12-11 (1976)	State and federal highway crossings
Highway Patrol	Issue overweight truck permits for delivery of materials to plant site	Utah Code Annotated Section 27-12-155 (1976)	Delivery of materials
UTAH DEPARTMENT OF HEALTH, DIVISION OF ENVIRONMENTAL HEALTH			
Bureau of Air Quality	Issue open burning permit	Utah Code Annotated Section 26-13-6(1) (Supp. 1981)	Burning of slash and waste material
	Approve notice of intent to construct source of air pollution (includes prevention of significant deterioration (PSD) permit)	Utah Code Annotated Section 26-13-6 (Supp. 1981)	Construction activity
Bureau of Water Pollution Control	Issue permit for construction and operation of sanitary and industrial wastewater treatment facilities	Utah Code Annotated Section 26-11-8 (Supp. 1981)	Wastewater treatment facilities
	Issue permit for reinjection of mine water	Utah Code Annotated Section 26-11-6(14) (Supp. 1981)	Underground injection wells

TABLE SS-3 (concluded)

MAJOR STATE AUTHORIZING ACTIONS

Agency	Nature of Action	Authority	Project Feature (Applicable Project)[1]
UTAH DEPARTMENT OF WATER POLLUTION Division of Environmental Health			
Bureau of Solid and Hazardous Waste	Issue permit to treat, store, or dispose of hazardous waste	Utah Code Annotated Section 26-14-8 (Supp. 1981)	Disposal of hazardous waste
	Approval for disposal of solid waste	Utah Code Annotated Section 26-14-6(6) (Supp. 1981)	Solid waste disposal
Bureau of Public Water Supply	Issue permit for drinking water system	Utah Code Annotated Section 26-12-5(a) (Supp. 1981)	Drinking water system
UTAH INDUSTRIAL COMMISSION Division of Occupational Safety and Health	Inspect surface construction for worker safety	Utah Code Annotated Sections 35-91 et seq. (1974)	Surface shale processing facilities downstream of pyrolysis units
DEPARTMENT OF COMMUNITY AND ECONOMIC DEVELOPMENT Division of Community Development	Receive Socioeconomic Impact Alleviation Plan	Utah Code Annotated Section 63-51-10 (Supp. 1981)	Socioeconomic and population increases

E=Enercor-Mono Power P.R. Springs Project

1SUnless specified, the authorizing actions apply to all of the proposed projects.

TABLE SS-4

MAJOR COUNTY AND LOCAL AUTHORIZING ACTIONS

Agency	Nature of Action	Authority	Project Feature (Applicable Project)[1]
UINTAH COUNTY			
	Issue building permits	Uintah County Zoning Ordinance	Plant site and surface facilities
	Issue temporary use permits	Uintah County Zoning Ordinance	Temporary construction of offices and sheds
	Issue conditional use permit	Uintah County Zoning Ordinance	Solid waste disposal sites
	Issue extraction of earth products permit	Uintah County Zoning Ordinance	Borrow areas
GRAND COUNTY			
	Issue excavation permit	Grand County Zoning Ordinance	Excavation (E)
	Issue building permit	Grand County Zoning Ordinance	Plant site and surface facilities (E)
	Approval of master plan by the Grand County Planning Commission and County Commissioners	Grand County Zoning Ordinance	New town site (E)
SALT LAKE CITY PLANNING AND ZONING COMMISSION	Review and approve plan to construct the alternative product pipeline	City Site Development Ordinance (Aug. 1981) Title 47, Chapter 5 Independent Site Development Activities	Construction of shale oil pipeline (T)[2]
SALT LAKE CITY ENGINEER	Issue site development permit, subject to review and approval of City Planning and Zoning Commission	City Site Development Ordinance (Aug. 1981) Title 47, Chapter 5 Independent Site Development Activities	Construction of shale oil pipeline (T)[2]
SALT LAKE COUNTY PLANNING AND ZONING COMMISSION	Issue approval of grading and drainage plan, and grant a variance to the Foothills Protection Zoning Ordinance	Foothills Protection Zoning Ordinance, Title 22 Chapter 35-38	Construction of shale oil pipeline (T)[2]
SALT LAKE COUNTY BUILDING INSPECTOR	Issue grading permit	Chapter 70 of the Uniform Building Code for unincorporated portions of the county, and the Foothills Protection Zoning Ordinance, Title 22, Chapter 35-38	Construction of shale oil pipeline (T)[2]
UNIVERSITY OF UTAH, BOARD OF REGENTS	Issue approval for an easement to cross University property within Chevron's existing easement	Univerisity of Utah, Board of Regents by-laws	Construction of shale oil pipeline (T)[2]
UNIVERSITY OF UTAH	Issue an easement to cross University property within Chevron's existing easement	University of Utah Master Plan for Facility Expansion	Construction of shale oil pipeline (T)[2]
UINTAH BASIN DISTRICT HEALTH DEPARTMENT	Issue inspection and letter of approval for public health-related facilities on plant sites and at construction camps	Utah Code Annotated, 1981 Supplement; Title 26, Chapter 24, Section 1-24	Construction camps, individual wastewater disposal systems, non-public water systems, and food service facilities at the plant sites
SALT LAKE CITY CORPORATION	Issue a revocable permit or easement to cross the City Creek Canyon watershed subject to review and affirmative recommendation by the Public Utilities Water Department to the Mayor; and mayorial approval	Utah Code Annotated, Section 10-8-2	Construction of a shale oil pipeline (T)[2]

E = Enercor-Mono Power P.R. Springs Project

[1]Unless specified, the authorizing actions apply to all of the proposed projects.

[2] Applies only to Tosco Salt Lake City Alternative Product Pipeline.

degrees Fahrenheit, emerges from the rock as a slow-flowing liquid that can be converted to synthetic crude oil.

Despite the common beginnings of the deposits in the Green River Formation, the resources vary widely in concentration and quality. In the Wyoming deposits, for example, there is relatively little kerogen compressed between the layers of rock. In Utah, the kerogen is more concentrated than that found in Wyoming, but deposits are relatively thin when compared with the great thick beds of kerogen-rich shale found in Colorado's Piceance Creek Basin.

The crude product which results from oil shale processing can be burned as a boiler fuel, or converted to syncrude and refined into liquid fuels and petrochemicals. The crude shale oil has properties that make it an excellent source of diesel and jet fuel, but it also can be converted to gasoline.

Gases recovered in the processing of shale can be recycled into the plant processes or be upgraded to a synthetic natural gas.

A typical oil shale project in the Uintah Basin would incorporate underground room-and-pillar mining with underground primary crushing. The crushed shale would be conveyed to storage and later hoisted to the surface. From there it would be transported by overland covered belt conveyors to a secondary crushing system, which would crush the shale to a size best suited to the type of retort being used. In some cases coarse ore would be stockpiled before crushing. After secondary crushing the shale would be conveyed to the retorting units.

Retorting would usually occur in parallel sets of retorting units which would produce raw shale oil. The raw shale oil from the retorts could then be upgraded to a high quality, low nitrogen, low sulfur hydrotreated shale oil product.

The degree of upgrading would vary from project to project. After recovery of the oil, gases, and by-products in the retorting and upgrading units, the remaining shale residue (called "spent" shale or retorted shale) would be cooled, moisturized, and conveyed to an on-site disposal area.

In most cases, a pipeline would be constructed to transport the oil to markets. By-products such as ammonia, sulfur, and coke would be transported by truck to a railhead or directly to market. Figure SS-1 shows the flow of materials for a typical commercial shale oil complex.

The product and by-product outputs of an oil shale facility are expressed on an operating "stream day" basis. A "stream day" is a day when the system operates at the designed rate. The average production for a year would be calculated by multiplying the "stream day" rate by 365 days (per year) by the

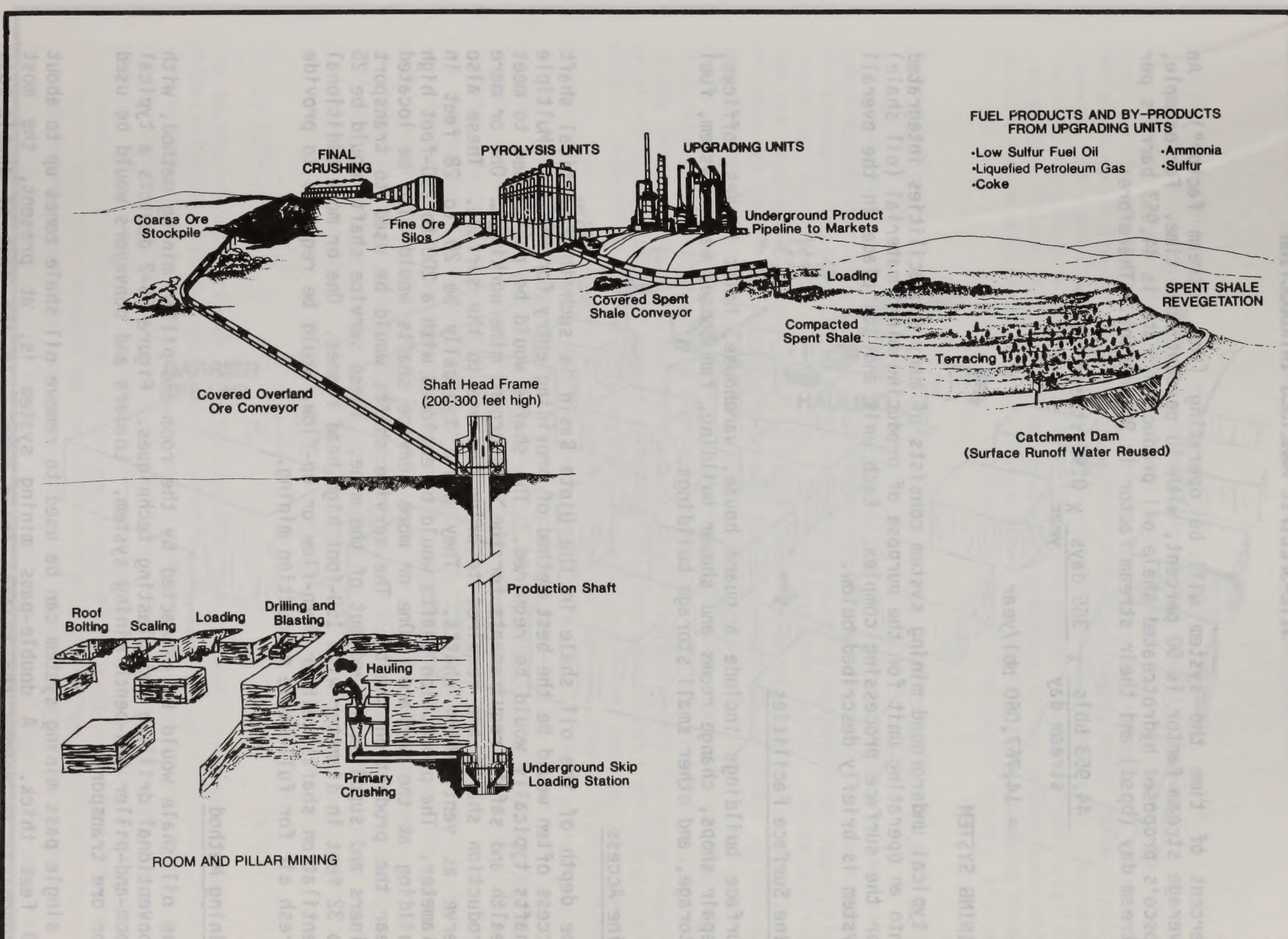


FIGURE SS-1 FLOW OF MATERIALS FOR A TYPICAL COMMERCIAL OIL SHALE COMPLEX

percent of time the system will be operating (the "stream factor"). An average stream factor is 90 percent, with 10 percent down time. For example, Tosco's proposed hydrotreated shale oil production rate is 44,953 barrels per stream day (bpsd) and their stream factor is 90 percent. Therefore:

$$\frac{44{,}953 \text{ bbls}}{\text{stream day}} \times \frac{365 \text{ days}}{\text{year}} \times 0.90 \text{ stream factor}$$

$$= 14{,}767{,}060 \text{ bbl/year}$$

MINING SYSTEM

A typical underground mining system consists of many subfacilities integrated into an operating unit for the purpose of producing mined material (oil shale) for the surface processing complex. Each unit and its place in the overall system is briefly described below.

Mine Surface Facilities

Surface buildings include a guard house, warehouse, hoist houses, offices, repair shops, change rooms and shower building, fan house, water system, fuel storage, and other small storage buildings.

Mine Access

The depth of the oil shale in the Uinta Basin is such that vertical shaft access often would be the best method of providing entry for mining. Multiple shafts typically would be required. The shafts would be positioned to meet health and safety requirements for the underground mine workings. One or more production shafts are required to bring the ore to the surface. These also serve as ventilation shafts. They would typically be 20 to 28 feet in diameter. The production shafts would be enclosed with a 200 to 250-foot high building at the surface. One or more service shafts would also be located near the production shafts. The service shafts would be used to transport miners and supplies in and out of the mine. These service shafts would be 25 to 32 feet in diameter with 150-foot high head frames. One or more additional ventilation shafts, either down-flow or up-flow, would be required to provide fresh air for full scale production mining.

Mining Method

The oil shale would be extracted by the room-and-pillar mining method, with conventional drilling and blasting techniques. Figure SS-2 depicts a typical room-and-piller two-bench mining system. Loaders and conveyors would be used for ore transport.

A single pass mining system can be used to remove oil shale zones up to about 40 feet thick. A double-pass mining system is, at present, the most economical to remove the thicker shale beds. In the case of double-pass

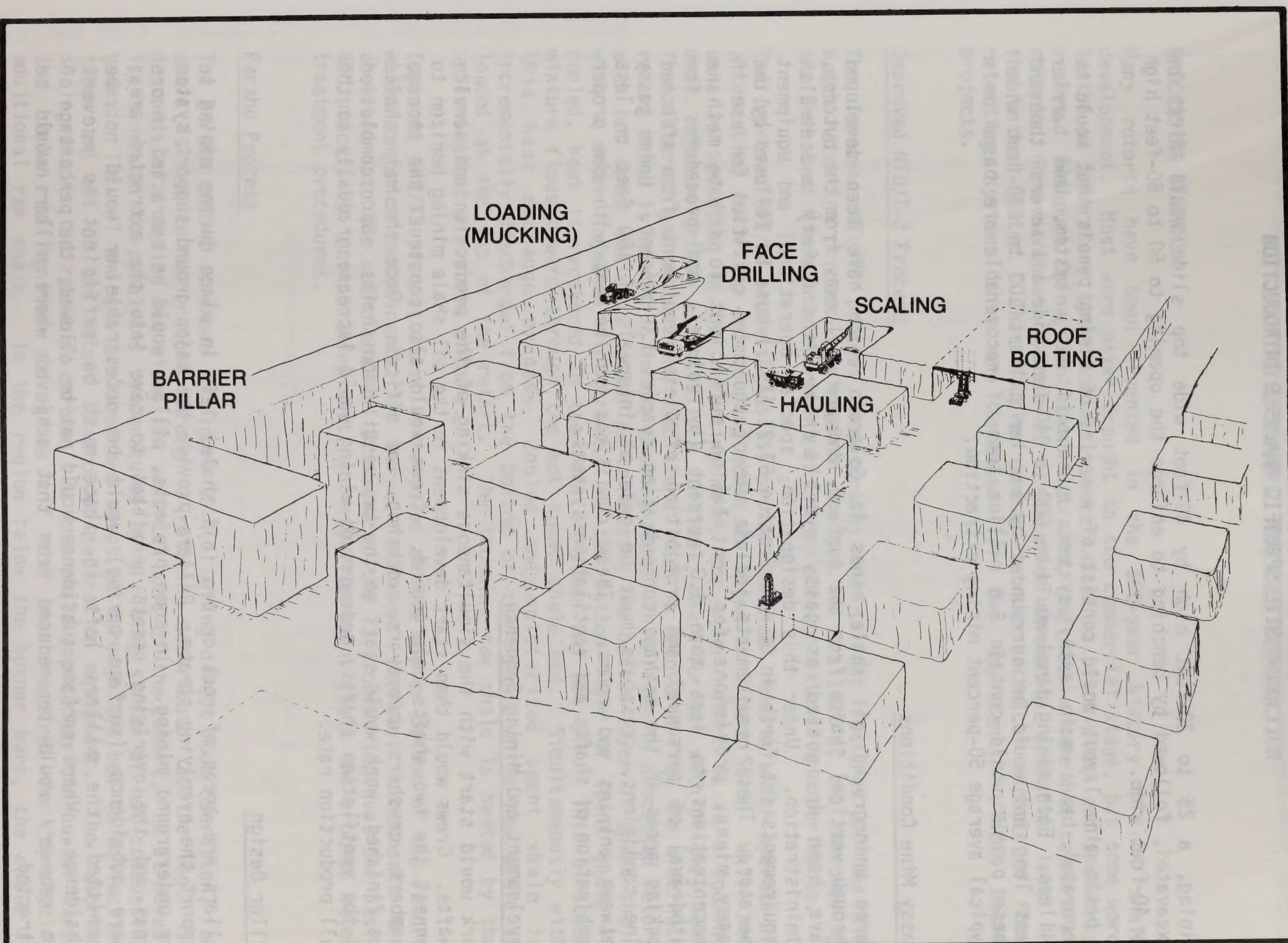


FIGURE SS-2 ROOM-AND-PILLAR TWO-BENCH MINING SYSTEM

mining, a 25 to 30-foot high by 40-foot wide top slide would first be excavated, followed by benching to enlarge the opening to 50 to 60-feet high by 40-feet wide.

A basic mine layout would consist of a series of mining panels that would be separated by a main entry system, a submain entry system, and barrier pillars. Each mining panel would be 600 to 840-feet wide and several thousand feet long and would be surrounded by barrier pillars 100 to 200-feet wide. These panels would contain 5.6 million tons of recoverable ore based on a typical average 50-percent mining extraction.

Gassy Mine Conditions

Three underground oil shale mines in Colorado which have been developed through vertical shafts from the surface, and are well away from the outcrop, have been designated as gassy mines by the Mine Safety and Health Administration. Under this designation, special operational and equipment requirements set forth in 30 CFR Section 57.21 (1981) must be followed by the operator. These requirements include use of equipment certified for use in gassy mines, provisions for ventilation sufficient to dilute methane concentrations to less than 1.0 percent (by volume), and procedures for withdrawal of personnel and prohibition of diesel equipment from affected working areas if the methane concentration reaches 1.0 percent. Under gassy mine conditions, crosscuts must be made at intervals of 100 feet or less between entries and rooms. These conditions can be met with the proper combination of shafts and ventilation systems.

Development and Mining Sequence

Work would start with the simultaneous sinking of the production and service shafts. Crews would then start development in the oil shale mining horizon to connect the two shafts underground. Crews would also construct the storage chambers, crushers, conveyors, workshop, and offices. Once the main shafts are finished, work would start on the two ventilation shafts. Upon completion of the ventilation shafts, underground mining would increase gradually to the full production rate.

Pillar Design

Pillars are areas of rock or ore (oil shale) left in place during mining to support the overlying strata. Pillars provide the major ground support system for underground mining. In some projects, pillars would be extracted in ore areas and the overlying strata permitted to cave into the extracted area. Where subsidence (surface caving) would be undesirable or would not be permitted, the pillars left in place must be sufficient to prevent subsidence. Where surface subsidence would not be allowed, the percentage of ore recovery would be reduced from that achieved where pillars would be extracted.

PROCESSING SYSTEMS

Many retorts have been invented in the 600-year history of oil shale development. Most were never brought to the commercial stage, but some were tested at laboratory scale and a few were tested at pilot-plant and semiworks scales. Although China, Scotland, Australia, and Russia have had commercial retorts, none have been tested at a sustained commercial operation level in the United States. This section summarizes the technical aspects of four retorting systems that are proposed for the applicants' Uintah Basin projects.

Improved NTU/T-3 Process

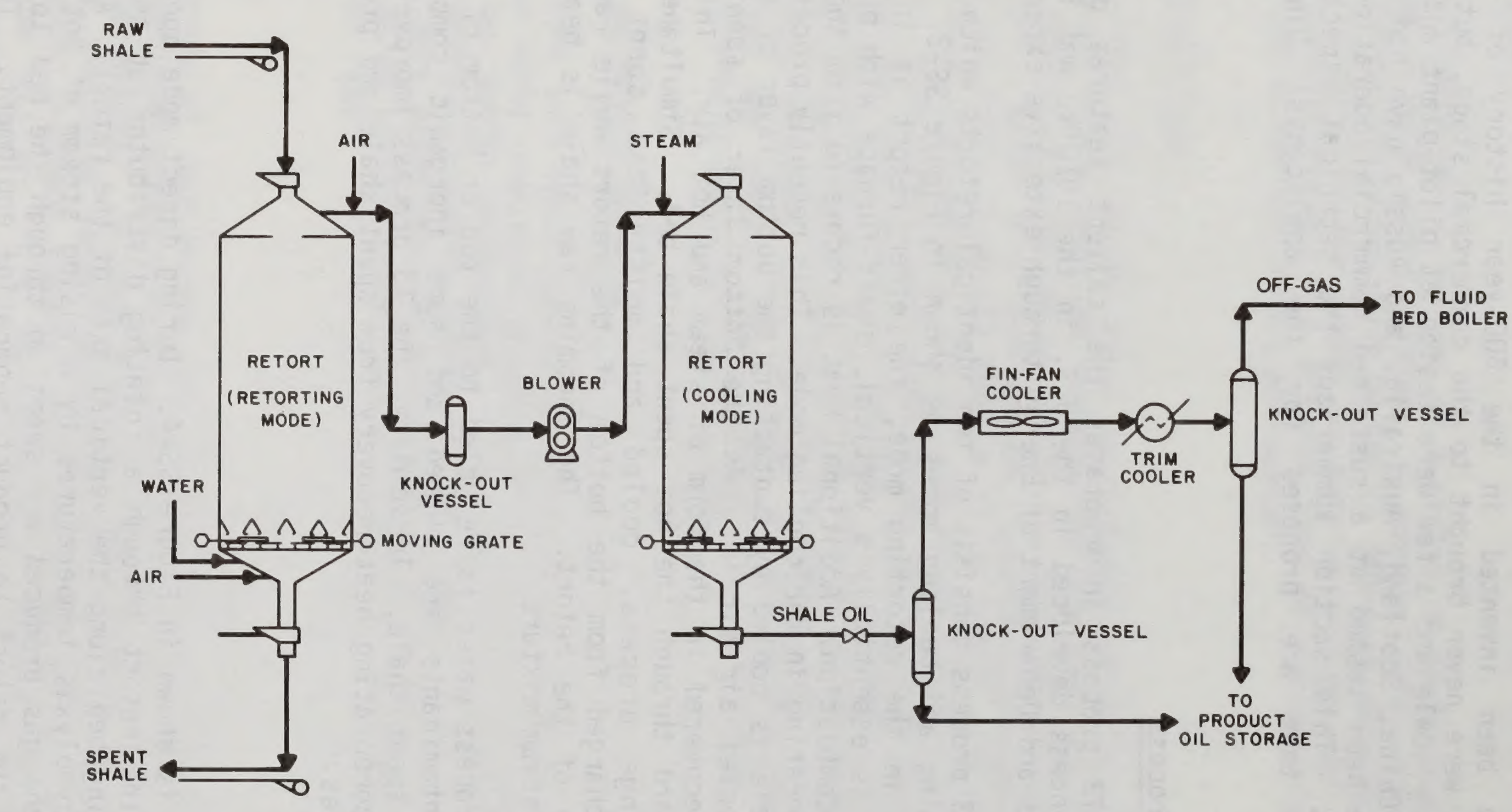
The Improved NTU/T3 process incorporates the salient features of the NTU batch retorting process developed in the U.S. in the 1920's, and improved by the Bureau of Mines and Department of Energy through extensive experiments.

The Improved NTU/T3 process consists of two identical retorts which operate in alternating retorting and cooling modes as shown in Figure SS-3. While one unit is operating in the retorting mode, the other retort is in a cooling mode. The retort is essentially a vertical, shaft-furnace with primary heat from internal gas combustion. Additional heat is recovered from the alternate retort which is operating in the cooling mode. This recently processed retort with hot spent shale is cooled by contacting the bottom layer of spent shale with a water injected air stream. As the bottom layer of spent shale is cooled, heat is recovered in the form of steam and hot air. This airsteam mixture flows upward through the hot spent shale bed. Simultaneously with this heat exchange process, cooled and moisturized spent shale is incrementally discharged from the bottom of the retort while raw shale is loaded at the top of the retort. The incoming raw shale is heated by the upflowing hot air-steam mixture.

Improved NTU/T3 process water is recycled to the top or bottom of the retort where organic contaminants are burned and some inorganic components are absorbed into the spent shale. In summary, the T3 process improves the basic NTU process by incorporating heat recovery from spent shale and process water treatment procedures.

Paraho Process

The Paraho retort is shown in Figure SS-4. During direct mode operation, raw shale is fed to the retort through a rotating distributor at the top. It descends as a moving bed along the vertical axis of the retort. As it moves, it is heated to pyrolysis temperatures by a rising stream of hot combustion gases. The oil and gas produced are swept up through the bed to collecting tubes and out of the retort to product separation equipment. The retorted shale retains the residual carbon. As the shale approaches the burner bars, the carbon is ignited and gives off the heat required for pyrolyzing additional raw shale. In the region below the burner bars, the shale is



NOTE: TWO IDENTICAL RETORTS OPERATING IN ALTERNATE MODES ARE SHOWN. IN THE COOLING MODE, RAW SHALE IS LOADED AS SPENT SHALE IS UNLOADED.

FIGURE SS-3 IMPROVED NTU/T³ RETORTING SYSTEM

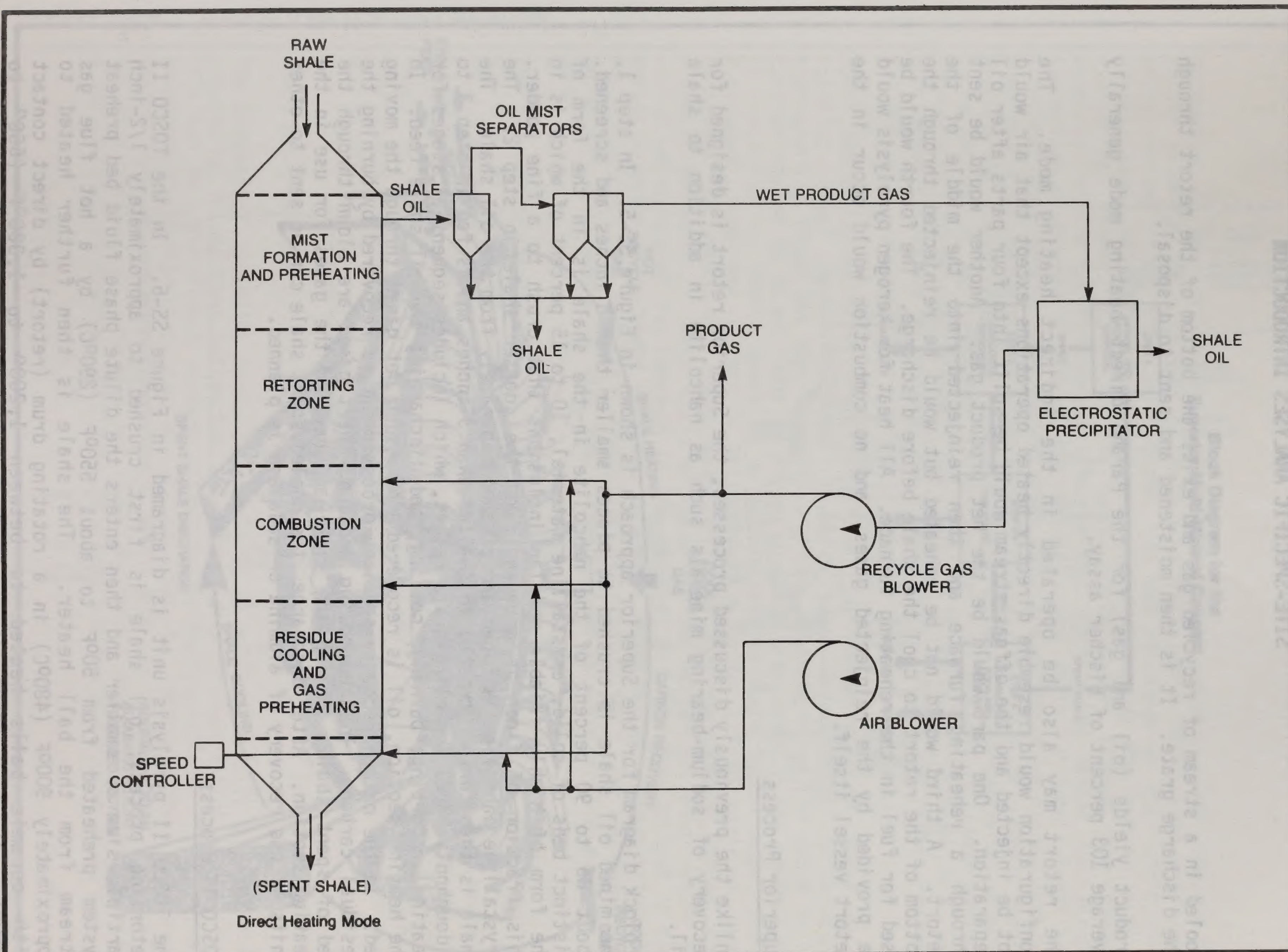


FIGURE SS-4 PARAHO RETORTING SYSTEM

cooled in a stream of recycled gas and exits the bottom of the retort through the discharge grate. It is then moistened and sent to disposal.

Product yields (oil and gas) for the Paraho direct heating mode generally average 103 percent of Fischer assay.

The retort may also be operated in the indirect heating mode. The configuration would resemble directly heated operations except that air would not be injected and the offgas stream would be split into four parts after oil separation. One part would be the net product gas. Another would be sent through a reheating furnace and then reinjected into the middle of the retort. A third would not be reheated but would be reinjected through the bottom of the retort to cool the shale before discharge. The fourth would be used for fuel in the reheating furnace. All heat for kerogen pyrolysis would be provided by the reinjected gases, and no combustion would occur in the retort vessel itself.

Superior Process

Unlike the previously discussed processes, the Superior retort is designed for recovery of sodium-bearing minerals such as nahcolite in addition to shale oil.

A block diagram for the Superior approach is shown in Figure SS-5. In step 1, the mined oil shale is crushed to pieces smaller than 8 inches and screened. About 85 to 90 percent of the nahcolite in the shale is in the form of distinct beds of solid, crystalline material, 10 to 15 percent of which is in the form of highly friable modular inclusions that crush to a fine powder. This fraction of finer is screened from the coarser shale in step 2. The crystalline nahcolite is mined and crushed separately from the oil shale. The shale is then further crushed to smaller than 3 inches and is fed in step 3 to a doughnut-shaped traveling-grate retort, which includes sequential stages for heating, retorting, burning, cooling, and discharging the oil shale feed. In the heating section, oil is recovered by passing hot gases through the moving bed. In the carbon recovery section, process heat is recovered by burning the residual carbon. In the cooling section, inert gases are blown through the bed of spent shale, cooling the shale and heating the gases for use in the heating section. After discharge, the cooled spent shale can be sent to other units if the recovery of alumina or soda ash is planned.

TOSCO II Process

The TOSCO II pyrolysis unit is diagramed in Figure SS-6. In the TOSCO II retorting process, oil shale is first crushed to approximately 1/2-inch particle size or smaller and then enters the dilute phase fluid bed preheat system preheated from 50°F to about 550°F (290°C) by a hot flue gas stream from the ball heater. The shale is then further heated to approximately 900°F (480°C) in a rotating drum (retort) by direct contact with ceramic balls heated to between 1,200° to 1,300°F (650° to 705°C). At about 900°F, the organic material (kerogen) in the oil shale

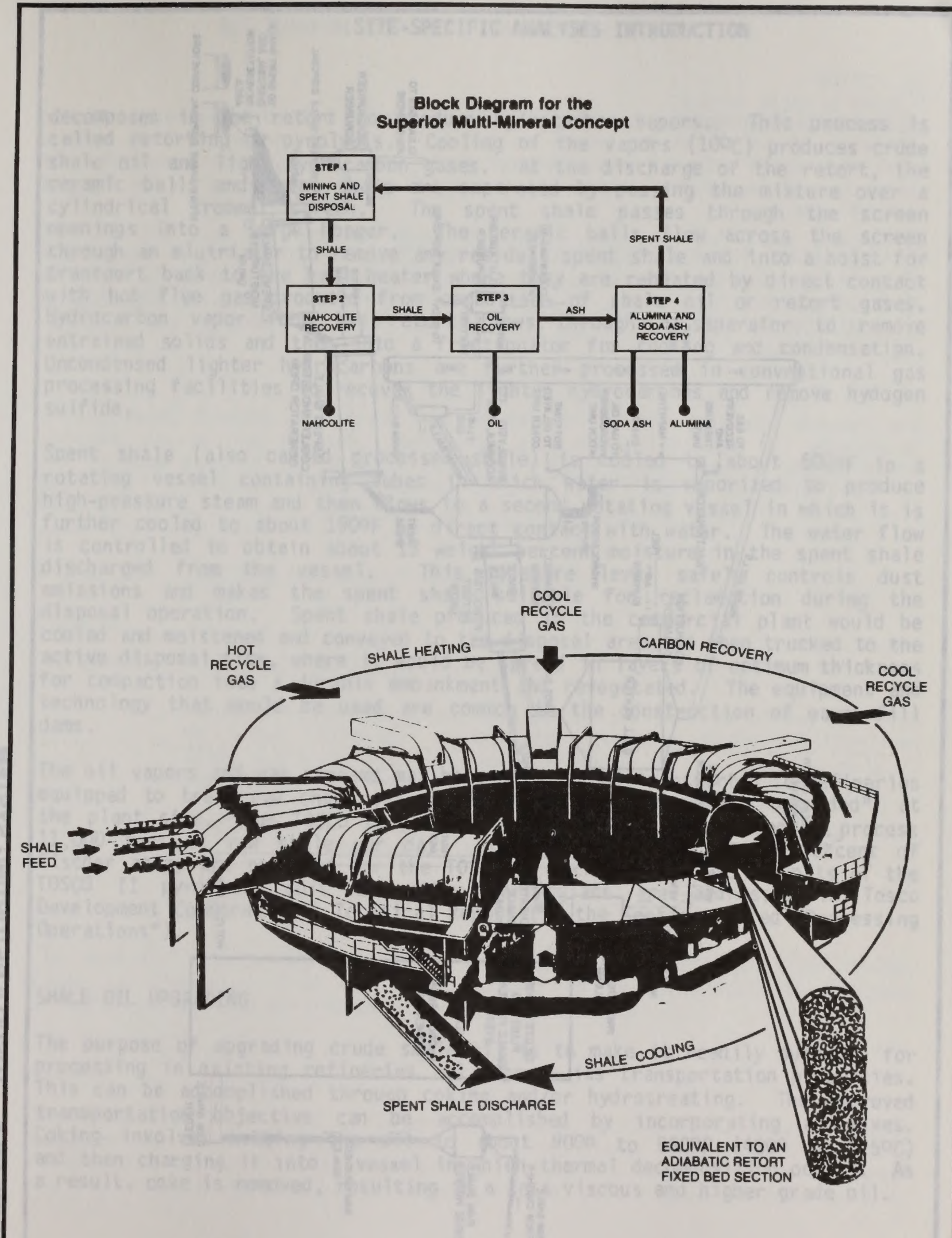


FIGURE SS-5 SUPERIOR RETORTING SYSTEM

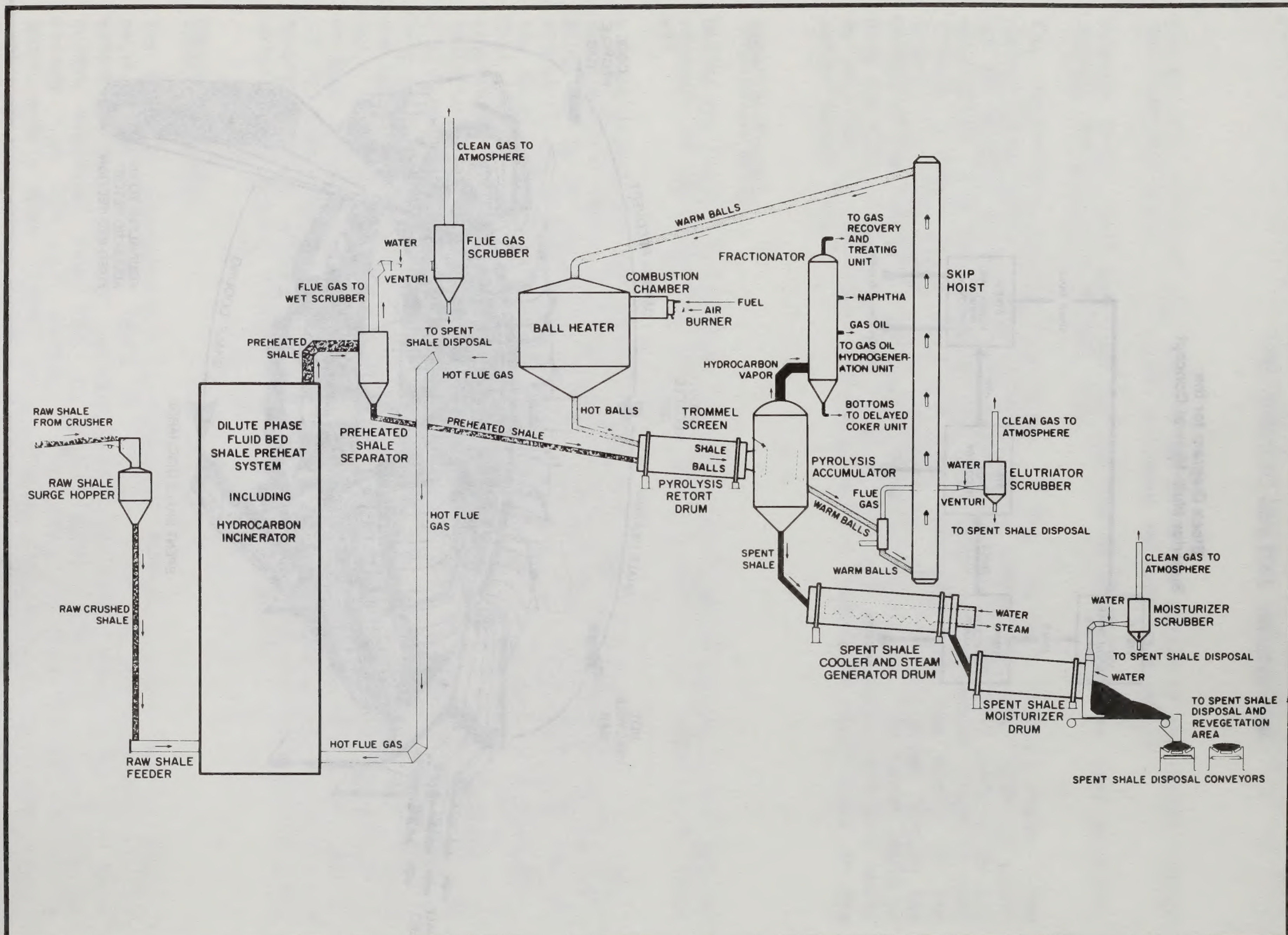


FIGURE SS-6 TOSCO II RETORTING SYSTEM

decomposes in the retort to produce hydrocarbon vapors. This process is called retorting or pyrolysis. Cooling of the vapors (10°C) produces crude shale oil and light hydrocarbon gases. At the discharge of the retort, the ceramic balls and spent shale are separated by passing the mixture over a cylindrical trommel screen. The spent shale passes through the screen openings into a surge hopper. The ceramic balls flow across the screen through an elutriator to remove any residual spent shale and into a hoist for transport back to the ball heater where they are reheated by direct contact with hot flue gas produced from combustion of shale oil or retort gases. Hydrocarbon vapor from the retort flows through a separator to remove entrained solids and then into a fractionator for cooling and condensation. Uncondensed lighter hydrocarbons are further processed in conventional gas processing facilities to recover the lighter hydrocarbons and remove hydogen sulfide.

Spent shale (also called processed shale) is cooled to about 500°F in a rotating vessel containing tubes in which water is vaporized to produce high-pressure steam and then flows to a second rotating vessel in which it is further cooled to about 190°F by direct contact with water. The water flow is controlled to obtain about 13 weight percent moisture in the spent shale discharged from the vessel. This moisture level safely controls dust emissions and makes the spent shale suitable for reclamation during the disposal operation. Spent shale produced in the commercial plant would be cooled and moistened and conveyed to the disposal area and then trucked to the active disposal site, where it would be spread in layers of optimum thickness for compaction into a durable embankment and revegetated. The equipment and technology that would be used are common in the construction of earth-fill dams.

The oil vapors and gas streams may be condensed and transported to refineries equipped to treat raw shale oil or may be further processed ("upgraded") at the plant site. The TOSCO II pyrolysis unit is presently sized to process 11,000 tons of raw shale per day. Hydrocarbon yields of 100 percent of Fischer assay are reported for the TOSCO II technology. The subunits of the TOSCO II pyrolysis unit and other particulars are addressed in Tosco Development Corporation's Technical Report (in the Section titled "Processing Operations").

SHALE OIL UPGRADING

The purpose of upgrading crude shale oil is to make it readily suitable for processing in existing refineries and improve its transportation properties. This can be accomplished through coking and/or hydrotreating. The improved transportation objective can be accomplished by incorporating additives. Coking involves heating the oil to about 900° to 980°F (480° to 525°C) and then charging it into a vessel in which thermal decomposition occurs. As a result, coke is removed, resulting in a less viscous and higher grade oil.

Hydrotreating involves reacting the crude shale oil with hydrogen in the presence of catalysts to reduce sulfur and nitrogen content. This process also results in a less viscous, higher grade oil. The hydrogen needed for the process must be manufactured from process off-gas or purchased in the form of natural gas.

Unlike coking and hydrotreating, incorporating additives such as pour point depressants changes the physical characteristics of the oil and not its chemical properties. Thus, it does not improve the quality of the oil, so its cost can be offset only if transportation costs are reduced.

DESCRIPTION OF PROPOSED ACTION AND ALTERNATIVES

E-1.A **INTRODUCTION**

Enercor proposes to develop the Rainbow Project, a tar sand processing facility. The development would be in two phases. An initial production phase of 2,000 barrels per stream day (bpsd) and an ultimate capacity phase of 5,000 bpsd. Development of the initial phase would require State of Utah approval and permits. However, the ultimate phase would require the issuance
Bureau of Land
BLM).

This chapter focuses on impact causing aspects of the proposed project and alternatives to that project. More detailed information about all aspects of the Rainbow project is included in Project Description for the Uintah Basin Regional EIS (Enercor 1982). Copies of this report can be obtained from Mr. Kent Hatfield, Enercor, American Plaza II, Suite 500, 57 West 200 South, Salt Lake City, Utah 84101.

E-1.A.1 PURPOSE AND NEED OF PROPOSED PROJECT

Purpose

The purpose of the proposed project is to:

1. Demonstrate the technical and economic viability of the modified hot water extraction process for producing crude oil from tar sand, a process that was developed under the joint sponsorship of Enercor and the State of Utah (University of Utah).

2. Produce 5,000 barrels per stream day (bpsd) of upgraded crude oil, to initiate commercial tar sand processing in Utah.

Need

The need for this project and other proposed synfuel projects in the Uintah Basin is similar. This need is discussed in the Site-Specific Analyses Introduction of this environmental impact statement (EIS).

E-1.A.2 LOCATION

The Rainbow project would be located in Uintah County, Utah, about 11 miles south of the former Rainbow townsite. Bonanza, Utah, is about 30 miles north of the site via the Atchee Ridge Road and Vernal is about 75 miles northwest via the Atchee Ridge Road, State Highway 45, and U.S. Highway 40 (Map R-1-1 in Section R-1.A).

E-1.A.3 AUTHORIZING ACTIONS

To implement the Rainbow project, certain federal, state, and local authorizing actions would have to be taken. Most of the actions that would be required to authorize the various synfuel development projects in Uintah County are similar; these are identified in the Site-Specific Analyses Introduction of this EIS. Specific BLM actions that would be required for authorization of the Rainbow project are granting the following rights-of-way across federal land:

- 20 miles of access road
- 15.4 miles of water pipeline
- 24.2 miles of power transmission line
- 3 miles of mine haul road

Enercor is in the process of applying for these rights-of-way.

E-1.A.4 INTERRELATIONSHIPS WITH OTHER PLANNED PROJECTS AND SPECIAL MANAGEMENT AREAS

Projects

The interrelated projects that occur in the area of influence of Uintah Basin synfuels development are shown on Tables R-1-2 and R-1-3 in Section R-1.A.

Special Management Areas

No special management areas, such as a wildlife refuge or wilderness area, would be adjacent to or in close proximity of the Rainbow project.

E-1.B **HISTORY AND BACKGROUND**

E-1.B.1 LEASES

In 1981 Enercor obtained an interest in leases that previously had been granted to another party by the State of Utah in Township 12 South, Range 25 East, for 640 acres. The lease term is for a undetermined number of years. No federal leases would be involved in the Rainbow project. The remaining 640 acres of the proposed plant and mine site are leased from a private party.

E-1.B.2 PERMITS

At the present time neither water nor air quality (Prevention of Significant Deterioration) permits have been applied for or issued for the Rainbow project.

E-1.C OVERVIEW OF PROPOSED ACTION AND ALTERNATIVES

E-1.C.1 GENERAL DESCRIPTION

Enercor proposes to develop the Rainbow project in a two-step, phased manner, with 2,000 bpsd of oil produced by late 1983 and an additional 3,000 bpsd produced by 1985. A project life of 20 years is planned.

The proposed project would involve the mining of tar sand, processing it to remove the bitumen (crude tar sand oil), upgrading the bitumen, transporting it to a refinery, and disposing the remaining spent sand after processing. Typically tar sand consists of sandsize particules that are weakly cemented to form soft sandstones or of uncemented sands that are slightly consolidated. It is the pore spaces in these materials that serve as the reservoir for the bitumen.

The proposed project would consist of the following components:

- 1,200-acre open pit tar sand strip mine, with a maximum depth of 100 feet and an average pit depth of 40 feet
- 25-acre hot water extraction and delayed coking processing plant
- Wastewater treatment and recycling system
- Spent shale disposal system
- Product transportation system
- Ancillary facilities including
    - access road (25 miles)
    - mine haul road (3 miles)
    - water pipeline (18 miles)
    - power transmission line (28.5 miles)
    - communication facilities

The overall project schedule as submitted by Enercor is shown in Figure E-1-1. This schedule is subject to change based upon completion of the EIS and decisions on the requested right-of-way grants. The estimated time required from start of construction to full-scale production is 3 years.

In addition to the proposed action, the following alternatives were analyzed for the Rainbow project: (1) project alternatives--No Action, and (2) component alternatives--White River Section 12, Range 23 East Alternative Water Supply System; Green River Alternative Water supply system; Green River Southern Loop Alternative Water Supply System; White River Section 12, Range 24 East Alternative Water Supply System; Southern Loop Alternative Power Transmission Line; and Paraho Tie Alternative Power Transmission Line.

E-1.C.2 LOCATION OF COMPONENTS

The proposed plant site, including the mine and other facilities, would be located on a 1,280 acre lease in Sections 32 and 36, Township 12 South, Range 25 East. Map E-1-1 shows the proposed location of the various plant and mine components and the rights-of-way on the lease area. Map R-A-1 (located in Appendix R-A) shows the location of all rights-of-way and their relationship to the other proposed synfuel projects in the Uintah Basin.

E-1.C.3 LAND STATUS AND OWNERSHIP

The proposed project area, including components on the lease area and off-site rights-of-way, would involve federal, state, and private lands. Table E-1-1 shows the miles and acres of each type of land required for the components of the proposed project and alternatives. Map R-A-3 (located in Appendix R-A) shows the land ownership graphically.

Both Enercor and Geokinetics Inc. have state mineral leases on the western section of the project area (Section 16). The Utah Division of State Lands has ruled that Geokinetics would develop the oil shale resource first, because in this location the oil shale bed is above the tar sand deposit, and Enercor would need to remove the oil shale in order to reach and develop the tar sands (Geokinetics 1982). (The Geokinetics Lofreco Project is described in Appendix R-C.)

E-1.D **PROPOSED ACTION**

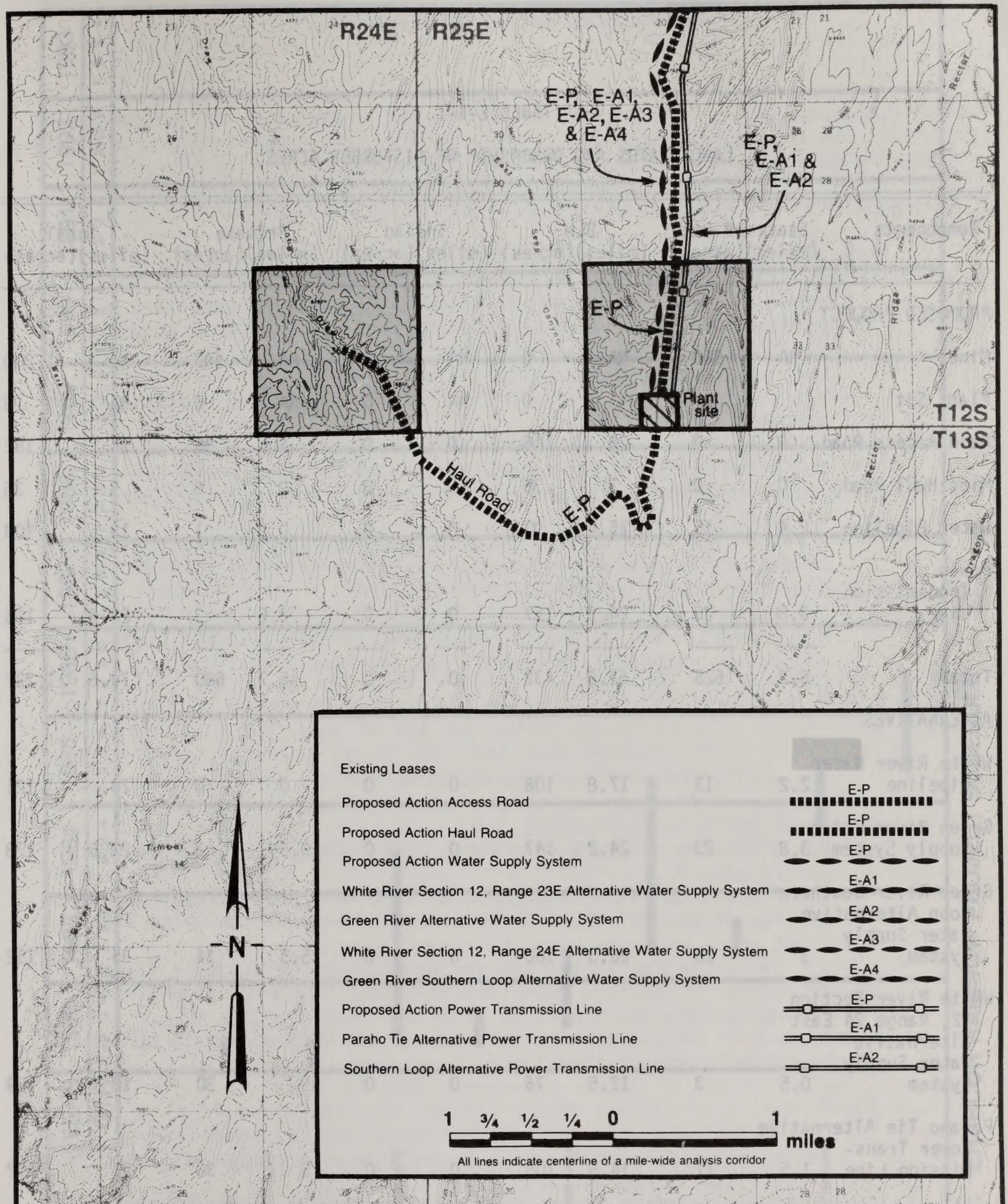
E-1.D.1 CONSTRUCTION, OPERATION, MAINTENANCE, AND ABANDONMENT

Construction

The proposed construction sequence would be access road improvement, power transmission line construction, plant and mine facility construction, water supply system construction, overburden removal, and mining operations start up. Some of these construction activities would proceed simultaneously as shown in Figure E-1-1. The construction work force would peak at 350 workers by 1984.

Construction of the facilties would involve movement of heavy equipment, materials, and personnel to the site. The types and amount of equipment and material to be transported to the site, the access routes to be used, and the frequency of trips have not been identified by Enercor.

Water required during the construction process would be trucked to the site from the White River until the water system is completed. The amount of water required during the construction process is unknown. Power requirements during the construction phase would be supplied from an existing Moon Lake Rural Electric Association (REA) power transmission line, and gas-powered, on-site generators.



MAP E-1-1 ENERCOR RAINBOW LEASE AREA FACILITIES

TABLE E-1-1

LAND STATUS AND OWNERSHIP OF DISTURBED ACRES

Components	State of Utah		BLM		Indian		Private		Total	
	(miles)	(acres)	(miles)	(acres)	(miles)	(acres)	(miles)	(acres)	(miles)	(acres)
PROPOSED PROJECT										
Mine	NA	560	NA	0	NA	0	NA	640	NA	1,200
Plant Sit				0	NA	0	NA	0	NA	25
Main Access Road	0	0	20	146	0	0	5	36	25	182
Mine Haul Road	0	0	3	36	0	0	0	0	3	36
Water Pipeline	2.4	15	15.4	93	0	0	0.2	1	18	109
Power Transmission Line	3.8	25	24.2	157	0	0	0.5	3	28.5	185
Total	6.2	625	62.6	432	0	0	5.7	680	74.5	1,737
ALTERNATIVES										
White River Water Pipeline	2.2	13	17.8	108	0	0	0	0	20	121
Green River Water Supply System	3.8	23	24.2	147	0	0	0.5	3	28.5	173
Green River Southern Loop Alternative Water Supply System	3	18	26.5	160	0	0	5.5	34	35	152
White River Section 12, Range 24 East Alternative Water Supply System	0.5	3	12.5	76	0	0	5	30	18	109
Paraho Tie Alternative Power Transmission Line	1.5	11	14.5	105	0	0	5	36	21	152
Southern Loop Alternative Power Transmission Line	3	22	26.5	192	0	0	5.5	40	25	254

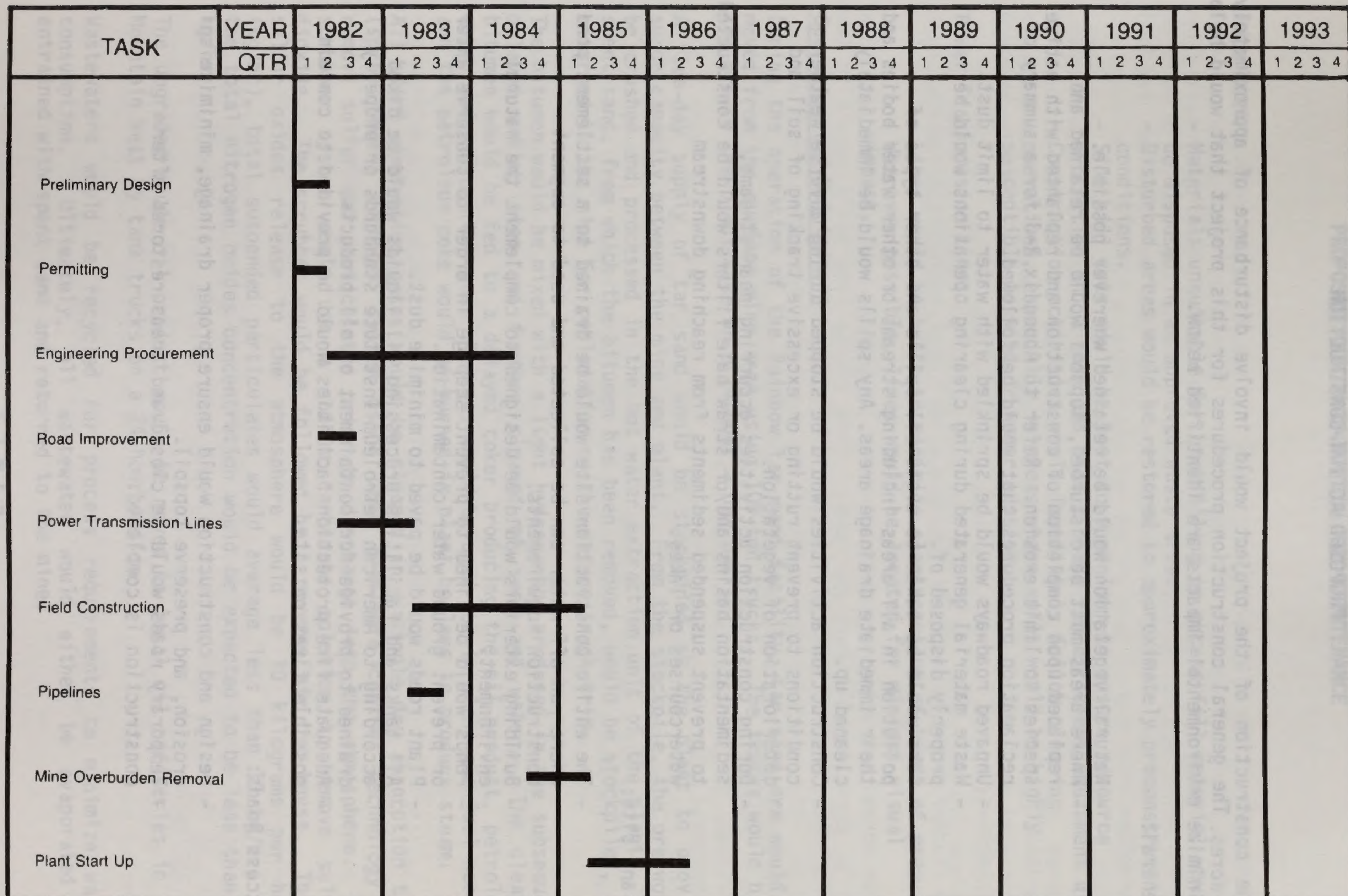


FIGURE E-1-1. ENERCOR RAINBOW PROJECT SCHEDULE

PROPOSED ACTION-CONSTRUCTION

The construction of the project would involve disturbance of approximately 1,737 acres. The general construction procedures for this project that would help minimize environmental impacts are identified below.

General:

- Natural vegetation would be retained wherever possible.
- Where areas must be disturbed, topsoil would be retained and replaced upon completion of construction and replanted with native species to limit erosion. Refer to Appendix R-J for a summary of reclamation procedures that would be followed.
- Unpaved roadways would be sprinkled with water to limit dust.
- Waste material generated during clearing operations would be properly disposed of.
- Care would be taken to avoid oil spills and other types of pollution in all areas including streams or other water bodies and their immediate drainage areas. Any spills would be immediately cleaned up.
- Construction activities would be stopped during adverse weather conditions to prevent rutting or excessive tracking of soil and deterioration of vegetation.
- During construction activities occurring near streams, sedimentation basins and/or straw bale filters would be constructed to prevent suspended sediments from reaching downstream watercourses or lakes.

Plant site:

- The entire construction site would be drained to a settlement pond where run-off water can be collected and used to augment construction requirements.
- Building exteriors would be designed to complement the natural environment.
- Ponds would be lined to prevent seepage in order to conserve water or prevent ground water contamination.
- Plant roads would be paved to minimize dust.
- All tanks and facilities processing oil liquids would be diked according to American Petroleum Institute standards or properly drained to provide for containment of oil products.
- Adequate fire protection facilities would be provided to contain possible fires on site.

Access Roads:

- Design and construction would ensure proper drainage, minimize soil erosion, and preserve topsoil.
- Temporary roads would be closed and areas restored after construction is completed.

Pipeline:

- Materials unsuitable for backfilling or excess fill material would be disposed in an approved waste area.
- Disturbed areas would be restored to approximately preconstruction conditions.
- Side hill cuts would be kept to a minimum to ensure resource protection and a safe and stable place for efficient equipment use.
- Construction activities would immediately follow clearing operations, especially in areas where soils would be highly susceptible to wind or water erosion.

Power Transmission Lines:

- Lines would be built to minimize electrocution of birds of prey.
- Wherever possible, lines would be located for minimal visual impact.

Operation and Maintenance

During the operation of the Rainbow tar sand facility, tar sand ore would be moved from the surface mine area using 100-ton trucks. The trucks would haul the ore to the plant site on a 24-hour a day basis.

A five-day supply of tar sand would be stockpiled at the plant to provide surge capacity between the mine and plant. From the stockpile, the ore would be crushed and processed in the hot water extraction unit of the plant. The spent sand, from which the bitumen has been removed, would be stockpiled, and returned to the mine for reclamation on the return truck trip.

The bitumen would be mixed with a light hydrocarbon produced in the subsequent delayed coking step and further cleaned of sand and water. The cleaned bitumen would be fed to a delayed coker producing the oil product, petroleum coke, and hydrocarbon gas. The gas would be used for in-plant gas fuel needs, and the petroleum coke would be burned in plant boilers to produce steam.

All plant combustion gases would be cleaned in a single dry absorption type (spray tower) scrubber system using best available control technology to remove sulfur and particulates prior to discharge into the atmosphere. The scrubber system would use a sodium carbonate solution to remove sulfur dioxide. The scrubber would be followed by a reverse air bag house. Total sulfur oxides release to the atmosphere would be 10 kilograms per hour (kg/hr), total suspended particulates would average less than 13 kg/hr, and the total nitrogen oxides concentration would be expected to be less than 11 kg/hr.

The upgraded crude oil product would be moved to local oil refineries in the Mountain West by tank trucks on a 24-hour basis.

Wastewaters would be recycled for process requirements to minimize water consumption. Ultimately, all wastewater would either be evaporated or entrained with spent sand and returned to the mine.

Maintenance of the plant would be typical of that associated with refinery and chemical plant procedures. All equipment would be shut down and cleaned prior to maintenance work. Full Occupational Safety and Health Administration (OSHA) safety procedures would be employed and new or repaired parts would be installed in an expeditious manner and the facility returned to full production.

Mechanical maintenance would be performed on mine vehicles in a routine, planned manner and equipment would be returned to service as soon as possible. Waste oil would be returned to the plant process and mixed with the coker feed or disposed of in the mine. The quantities that would be involved are unknown.

The crusher building would be equipped with a dust suppression system. Dust suppression may be installed on storage piles if required.

Under normal operating procedure, the mine would have a three-shift operation for an estimated 330 days per year. This mining rate would result in the production of 5,000 bpsd of tar sand oil based on a 90 percent on-stream factor. The remaining 10 percent of the time would be used for maintenance. The processing plant would operate on a 24-hour basis.

Operation of the proposed Rainbow project would require the following resources:

- Tar sand ore from the mine (10,920 to 16,000 tpsd depending on ore grade mined; approximately 4.5 million tons/year).
- Soda ash transported by truck from Green River, Wyoming (10 tons per day, three trucks per week).
- Polymer, 470 pounds per day, transported by truck from an unknown source; one shipment every three to four months.
- Power from Bonanza Power Plant via 138 kV transmission line; 7,500 kW.
- Water from White River via an 8-inch pipeline (5,000 acre-feet per year).
- Diesel fuel from local refineries via tank truck (8,650 gallons per day; approximately one tank truck per week).

The on-site operation work force would peak at 275 workers by 1985.

Abandonment

Detailed abandonment plans are not available, because the conditions that may exist at the end of the projected 20-year project life are unknown. However, the following may be what would occur.

All disturbed areas would be returned to the original topographic configuration and revegetated with approved plant species as appropriate. Roads would be reclaimed by removing surfacing materials and returning the materials to the plant site for burial in the spoil pile. The roads would be backfilled and regraded to blend with the post-mining contours and revegetated. Regulatory authorities may decide that certain main roads shall remain to allow access into the area. Arrangements would need to be made to transfer control of these roads to the appropriate authorities.

Surface facilities such as the shop-warehouse, office building, and power transmission line would be removed, with disposal off site. Paved areas would be removed and the residue would be taken off site for disposal. Compacted areas would be ripped to loosen the surface, after which topsoil would be spread, and then the area would be revegetated.

E-1.D.2 PROJECT COMPONENTS

Mine System

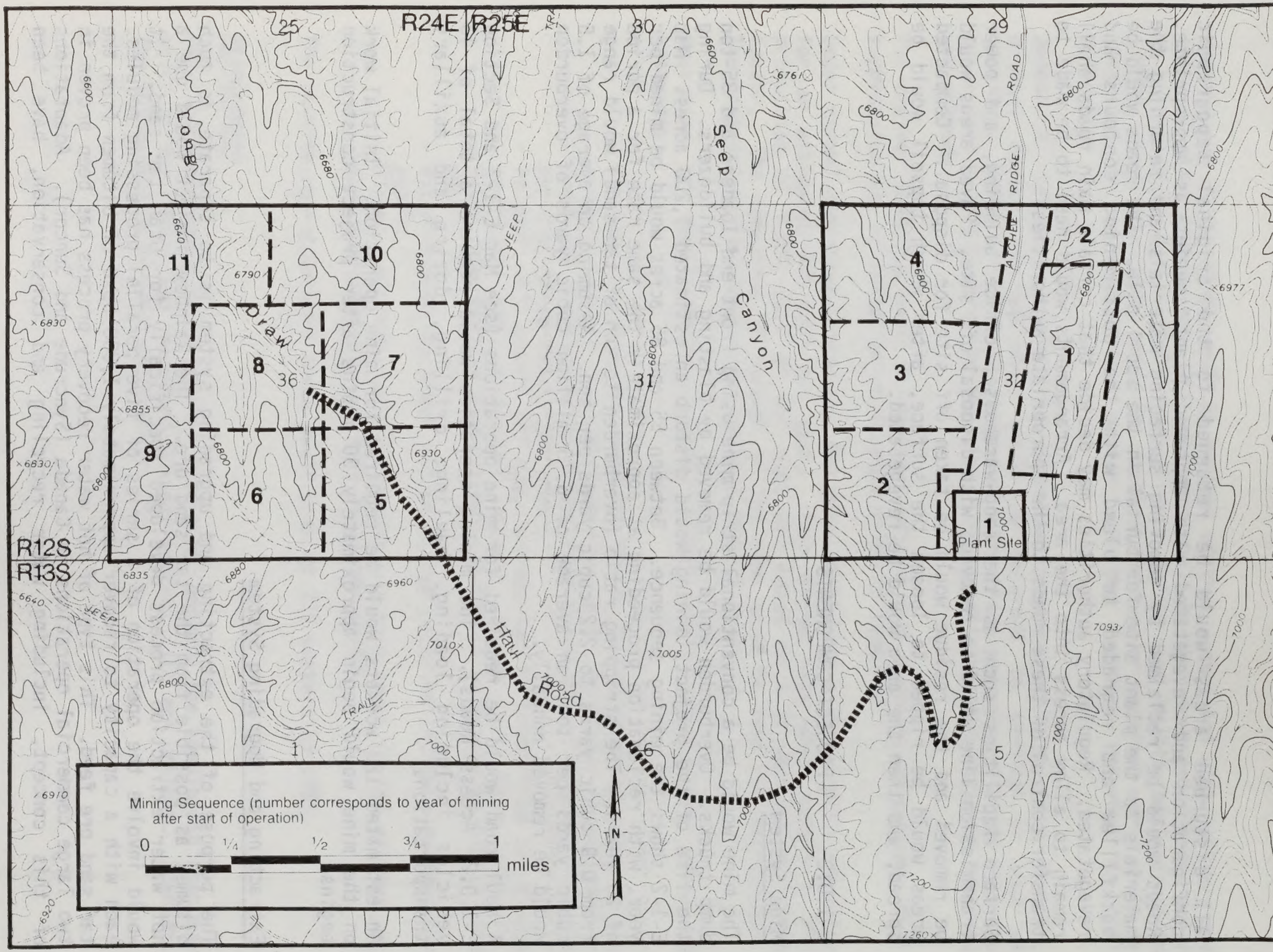
The mine would be a conventional strip mine using front end loaders and 85-ton dump trucks. Overburden would be removed by blasting and bulldozers. During the life of the project, mining would disturb an estimated 1,200 acres. Map E-1-2 shows the mining sequence. Between 55 and 85 acres would be mined per year, with reclamation proceeding at approximately the same rate for a period of 20 years. The stripping ratio (overburden to ton of tar sand) would range from 0.9 cubic yards to 2.2 cubic yards per ton. Assuming an average of 1.5 cubic yards per ton, an average of 6.75 million cubic yards of overburden would be removed annually.

A haul road would be required for mine operations (see Map E-1-2 and Section E-1.D.2, Access Roads). The mining operation would require a total of 43 vehicles including loading, hauling, drilling, dozing and auxillary transportation.

An estimated 120 workers would be required for mine operation. Initial work on the mine would begin approximately 30 months after project construction begins.

Extracting and Upgrading System

The purpose of the extracting and upgrading system is to separate as much bitumen as possible from the tar sand ore. The Rainbow project would use a hot water extraction process developed specifically for Utah tar sand. It would involve the operation of a series of five parallel processing modules, each with a capacity to recover approximately 1,000 bpsd of bitumen from the tar sand ore feed. This type of hot water recovery process has been proven in two large commercial operations in Canada (Syncrude and Suncor). Adaptations of this concept, including water recycling and conservation, have been



MAP E-1-2 RAINBOW MINE MINING SEQUENCE

successfully tested by Enercor and the State of Utah (University of Utah) on a pilot-plant scale using Utah tar sand material. In the Rainbow project, a delayed coking upgrading facility would be coupled with the hot water process.

The extracting and upgrading would include of the following process steps:

1. Hot water processing
2. Bitumen cleanup
3. Sand and water cleanup
4. Bitumen delayed coking
5. Steam production
6. Flue gas desulfurization
7. Refining or upgrading

The overall system is illustrated in Figure E-1-2.

In the extraction process, crushed feedstock (raw tar sand) would be agitated in drums. The turbulence (rubbing of oil coated sand granules together) would scour the oil from the sand. The separated oil and scoured sand would be suspended in a water medium and steam and soda ash added to the mixture. The mixture would be slurried into flotation vessels where the slurried sand would settle and be removed.

Bitumen would float to the surface through air injection. The bitumen froth would be collected and receive a final cleanup using a solvent which would separate the remaining water and sand. The cleaned bitumen would then be processed by distillation to recover the solvent for recycling and the bitumen for delayed coking. The coker liquid products would be sold.

Wastewater Treatment System

The Enercor hot water extraction process would recycle the majority of the water used during the process. The only water that would leave the plant would be that associated with the damp sand, which would contain 10 to 15 percent moisture by weight. The damp sand would be returned to the mine area as part of the mine reclamation process. The mine would have an impervious bottom which would contain any water that might seep from the spent sand.

Other wastewater streams such as cooling tower blowdown, boiler feed water blowdown, separator effluent, and wastewater from the coker would be collected and used along with fresh replacement water as waste sand filter wash. The plant process areas would be graded to allow process water, spills, and wash-up to drain into a process ditch system. This system would flow to the 2.5-acre plant water containment pond. The water from the pond would generally be removed for process recycling. Nonprocess areas would be drained into a general storm drainage system which would include a sediment pond. Excess storm water could be directed from the pond to East Seep Canyon located immediately west of the plant site.

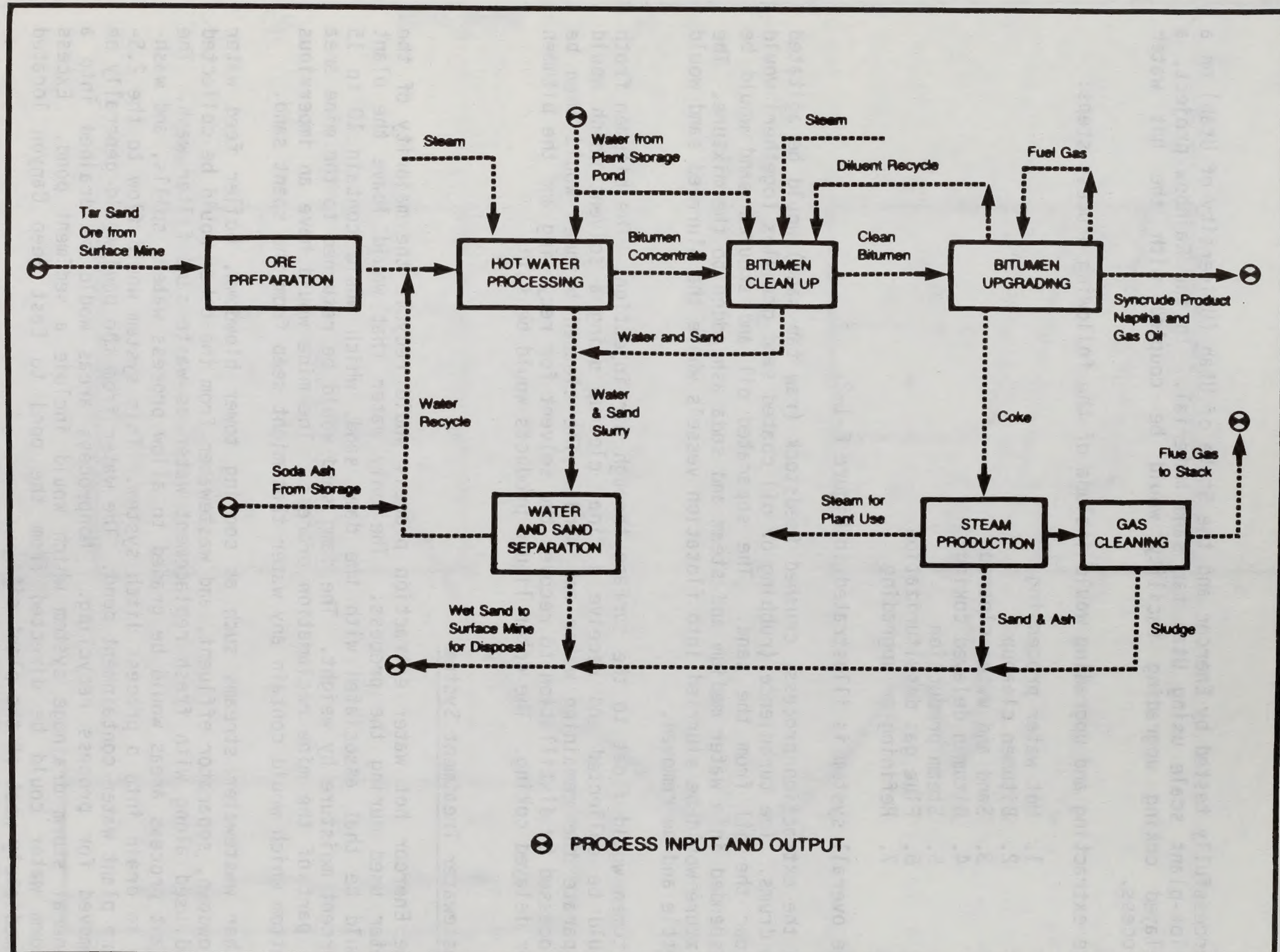


FIGURE E-1-2 ENERCOR EXTRACTING AND UPGRADING SYSTEM

Spent Sand Disposal System

The main solid waste stream produced by the plant would be spent tar sand ore. The spent sand is expected to contain 5 percent of the original bitumen as unrecovered material (95 percent of the bitumen would be removed in processing), approximately 10 to 15 percent moisture, a trace of soda ash, and the original silica sand which was present in the ore. A small amount of air pollution control scrubber sludge (16 tpsd) would be mixed with the spent sand prior to disposal. The sludge is expected to contain two-thirds fine sand (by weight), which originated from the tar sand ore; the remaining third would be sodium bisulfate and sulfite produced from sulfur dioxide scrubbing with soda ash solution. The spent sand would be trucked to the mine for disposal. It would be covered by overburden, then top soil, and subsequently reclaimed using the reclamation procedures summarized in Appendix R-J.

Product Transportation

The 5,000 bpsd of crude oil would be transported by truck from the plant site to refineries in the area. An average of 25 truck loads per day, on a 24-hour basis, would be required for transportation. The specific refineries have not been identified.

Ancillary Facilities

Access Roads

The proposed 25-mile plant access road is the existing Atchee Ridge Road. This main access road follows the existing improved dirt road from Bonanza to the plant site (Map R-A-1, located in Appendix R-A). It would be upgraded to form a 60-foot wide, hard surfaced, all-weather road. This upgrading would disturb 182 acres, which would be occupied by the road until project termination. Grades on the main access road would be minimized and proper drainage and erosion control would be provided.

A 3-mile mine haul road would be required between the two lease areas (Map E-1-2). It would be constructed during the mine operation and would be restricted to use by mine haul trucks only. The road would be improved and coated with tar sand. A 100-foot wide right-of-way would be required.

Approximately 36 acres would be disturbed during construction and would be occupied by the road for the life of the project.

Some temporary access roads would be required during the construction of the water pipeline and power transmission line. However, the number and mileage required is unknown at this time.

Water Supply

Plant operation at the 5,000 bpsd level would require a maximum of 5,000 ac-ft/yr of water. This water would be obtained from the White River (assuming the White River Dam would be in operation). Water would be pumped from the river into a 0.5-acre, clay-lined, mud settling pond. Clear water from the pond would be pumped 18 miles to the plant site via an 8-inch diameter pipeline. The pipeline would be constructed of welded steel, coated, wrapped, and buried at least 3-feet deep.

A 20-day supply of raw water would be stored in a pond which would occupy about 4 acres on the plant site. Process water would be used on an "as-received" basis. Domestic water would be stored, filtered, and chlorinated to meet Utah health standards.

Power Supply

The proposed power source would be the Bonanza Power Plant, presently under construction. A 28.5-mile, 138-kV transmission line would be required to supply the necessary power. Construction of this line would disturb 185 acres. This acreage would be reclaimed within 1 to 2 years after construction. The construction procedures and type of power transmission line design are described in the Moon Lake Power Plant EIS (BLM 1981c).

Solid Waste Disposal

The major solid waste generated would be spent tar sand (see Spent Tar Sand Disposal section). Scrubber sludge waste would be disposed with the spent tar sand.

Hazardous Waste Disposal

No known hazardous materials would be handled or produced by the project (Enercor 1982).

Communication System

A Mountain Bell telephone system would be used. The telephone lines would be located on the same pole system as the electric power transmission lines.

E-1.E **ALTERNATIVES**

E-1.E.1 WHITE RIVER SECTION 12, RANGE 23 EAST ALTERNATIVE WATER SUPPLY SYSTEM

Under this alternative, water would be obtained from the White River, but the pipeline would follow a different route than identified for the proposed project. The pipeline would be a total of 20 miles long, and disturb 121 acres (Map R-A-2, located in Appendix R-A). All other aspects of the alternative water system would be the same as described for the proposed action.

E-1.E.2 GREEN RIVER ALTERNATIVE WATER SUPPLY SYSTEM

This alternative would involve obtaining water from the Green River and transporting it to the plant site through a 28.5-mile long, 8-inch diameter pipeline (Map R-1-2, located in Appendix R-A). Construction of the alternative would take 1 year and disturb 173 acres. Water from the Flaming Gorge Reservoir would be purchased before it could be released in the Green River and subsequently pumped to the plant. All other aspects of the alternative water system would be the same as described for the proposed action.

E-1.E.3 GREEN RIVER SOUTHERN LOOP ALTERNATIVE WATER SUPPLY SYSTEM

This alternative would involve obtaining water from the Green River and transporting it from the Bonanza Power Plant to the Enercor plant site through a 35-mile long, 8-inch diameter pipeline (Map R-A-2, located in Appendix R-A). This alternative would utilize the Bonanza Power Plant water intake structure and pipeline Construction of the alternative would disturb 212 acres for 1 year. Water from the Flaming Gorge Reservoir would be purchased before it could be released in the Green River and withdrawn at the intake structure. All other aspects of this alternative water system would be the same as described for the proposed action

E-1.E.4 WHITE RIVER SECTION 12, RANGE 24 EAST ALTERNATIVE WATER SUPPLY SYSTEM

This alternative would involve obtaining water from the White River and transporting it to the plant site by way of a different route than that identified for the White River Section 12, Range 23 East Alternative Water Supply System. The pipeline would be 18 miles long and disturb 109 acres (Map R-A-2, located in Appendix R-A). All other aspects of the alternative water system would be the same as described for the proposed action.

E-1.E.5 SOUTHERN LOOP ALTERNATIVE POWER TRANSMISSION LINE

This alternative would involve a 35-mile long power transmission line that would disturb 254 acres. It would follow the same right-of-way as the Green River Southern Loop Alternative Water Supply System (Map R-A-2, located in Appendix R-A). All other aspects of this alternative power transmission system would be the same as described for the proposed action.

E-1.E.6 PARAHO TIE ALTERNATIVE POWER TRANSMISSION LINE

This alternative would involve a 21-mile power transmission line that would disturb 152 acres. It would follow a designated corridor from the Rainbow least area to the Paraho plant site. It would also follow the White River Section 12, Range 24 East Alternative Water Supply System to its point of intersection with the White River (Map R-A-2, located in Appendix R-A). All other aspects of this alternative power transmission system would be the same as described for the proposed project.

E-1.E.7 NO-ACTION ALTERNATIVE

The No-Action Alternative would involve the denial of the requested rights-of-way for the access road, water pipeline, and power transmission line (refer to the No-Action Alternative section of the Site-Specific Analyses Introduction of this EIS for additional explanation of the purpose of this alternative). This denial would not prohibit the project from developing to its initial capacity of 2,000 bpsd. It would eliminate the possibility of the projected full development level of 5,000 bpsd.

The 2,000 bpsd facility would be built using the existing access road with no improvements, using the existing small power transmission line and on-site generation, and trucking the required water to the plant site. Also, only the mine area on Section 32 would be developed (Map E-1-1). The project life would be only 10 years.

E-1.E.8 ALTERNATIVES CONSIDERED BUT ELIMINATED FROM DETAILED ANALYSIS

Ground Water Supply System

On-site wells were considered as a source of the 5,000 ac-ft/yr of water required for the project. Field investigations conducted at the Rainbow site indicated that only small quantities of water are in storage in the unconfined alluvium of the area. Also, the plant site is in the general vicinity of ground water supplies that have total dissolved solids concentrations greater than 3,000 milligrams per liter (mg/l) (Utah Department of Natural Resources 1978). Concentrations above 2,000 mg/l are consider to be highly saline and may be unacceptable for tar sand processing (Enercor 1982).

E-1.F DATA SUMMARY

Various aspects of the proposed Rainbow project and alternatives (where applicable) are summarized in Table E-1-2, Magnitude and Duration of Land Disturbance; Table E-1-3, Resources Used During Operation; Table E-1-4, Personnel Requirements; and Table E-1-5, Total Controlled Emissions.

TABLE E-1-2

MAGNITUDE AND DURATION OF LAND DISTURBANCE

Component	Length (miles)	Construction Width/Size	Operation Width/Size	Maximum Disturbed Acres/Duration[c]	Removed Acres/Duration	Reclaimed Acres
PROPOSED ACTION						
Mine	N/A	N/A	N/A	1,200/20 years	600[a]	1,200
Plant	N/A	1,043 ft x 1,043 ft	SAME	25/20 years	25/20 years	0
Mine Haul Road	3 mi	100 ft	100 ft	36/20 years	36/20 years	0
Access	25 mi	60 ft	60 ft	182/20 years	182/20 years	0
Water Pipeline[b]	18 mi	50 ft	10 ft	109/1 years	0	109
Power Transmission Line	28.5 mi	20 ft road 50 ft at plant	20 ft	185/1-2 years	0	185
Communication Systems	No Additional Acres (in Power Transmission Line Right-of-way)					
TOTAL				1,737	843	1,494
ALTERNATIVES						
White River Section 12, Range 23 East Water Supply System	20 mi	50 ft	10 ft	121/1 year	0	121
Green River Water Supply System	28.5 mi	50 ft	10 ft	173/1 year	0	173
Green River Southern Loop Water Supply System	25	50 ft	10 ft	212/1 year	0	212
White River Section 12, Range 24 East Water Supply System	18	50 ft	10 ft	109/ 1 year	0	109
Paraho Tie Power Transmission Line	21	20 ft/50 ft at each pole	20 ft	152/1 year	0	152
Southern Loop Power Transmission Line	35	20 ft/50 ft at each pole	20 ft	254/ 1 year	0	254

N/A = not applicable

[a]Half of mine would be out of production at any one time.

[b]Less than one additional acre would be disturbed by the associated pump station.

[c]Maximum disturbed duration equals maximum duration and/or active land use.

TABLE E-1-3

RESOURCES USED DURING OPERATION[a]

Tar Sand	13,650 tons/day (4,505,000 tons/year)
Water	5,000 acre-feet/year
Power	7,500 kilowatts/day
Diesel Fuel	8,650 gallons/day
Polymer	470 pounds/day
Soda Ash	10 tons/day

[a]Full production level.

TABLE E-1-4

PERSONNEL REQUIREMENTS

Year	Construction	Operation	Total
1982	130	0	130
1983	200	60	260
1984	350	120	470
1985	75	275	350
1986-2006	0	275	275

TABLE E-1-5

TOTAL CONTROLLED EMISSIONS

Type	Emission Rate (Kilograms/hour)
Sulfur Oxides	10
Nitrogen Oxides	11
Total Hydrocarbons	Unknown
Total Suspended Particulates	13
Carbon Monoxide	Unknown

COMPARATIVE ANALYSIS OF PROPOSED ACTION AND ALTERNATIVES

The Enercor Rainbow Project proposed action, component alternatives, and the No-Action Alternative are compared in this chapter. Various component alternatives and components of the proposed action can be assembled into a range of complete system alternatives. Tables E-2-1 and E-2-2 provide a comparative analysis of significant unavoidable and quantifiable impacts of the proposed action and the alternatives that would result if the Rainbow project is implemented. Unavoidable adverse impacts listed in the table are negative environmental impacts that would remain despite mitigation efforts. Adverse impacts that are of low significance or of very short duration are not included.

TABLE E-2-1

SUMMARY COMPARISON OF IMPACTS BETWEEN PROPOSED ACTION AND WATER SUPPLY ALTERNATIVES

Environmental Element*	Proposed Action	White River S. 12, R. 23 E. Alternative Water Supply System	White River S. 12, R. 24 E. Alternative Water Supply System	Green River Alternative Water Supply System	Green River Southern Loop Alternative Water Supply System
Air Quality	10 kg/hr SO_2 11 kg/hr of NO_x 13 kg/hr of TSP	**	**	**	**
Water Resources	5,000 ac-ft/yr flow reduction in White River (1% of avg. ann. flow)	**	**	5,000 ac-ft/yr flow reduction in Green River (0.1% of average annual flow)	5,000 ac-ft/yr flow reduction in Green River (0.1% of average annual flow)
Vegetation, Soils, and Reclamation	1,737 ac disturbed of which 243 ac not reclaimed	12 ac more disturbed	**	64 ac more disturbed	103 ac more disturbed
Wildlife	1,737 ac of habitat disturbed	12 ac more disturbed habitat	**	64 ac more disturbed habitat	103 ac more disturbed habitat
Agriculture	133 AUMs lost for grazing on rangeland	1 AUM less grazing		7 AUMs less grazing	1 AUM more grazing
Visual Resources	15 ac VRM values affected	3 ac more VRM Class II affected	9 ac more VRM Class II affected	6 ac VRM Class III affected rather than 3 ac VRM Class II	9 ac more VRM Class II affected
Land Use Plans	12 mi of water pipeline and 12 mi of transmission line outside BLM planning corridor. 3.0 mi within White River BLM protected zone	4 mi more outside BLM planning corridor 3.5 mi within White River protected zone	most of pipeline within BLM planning corridor	9 mi more pipeline outside BLM planning corridor. 1.0 mi in White River BLM protected zone	most of pipeline within BLM planning corridor. 1.0 mi in White River BLM protected zone

NOTE: Figures are the projected change to baseline due to development of the Enercor project.

When "more" or "less" appears in the description of alternative impacts, impacts are being compared to comparable components or processes of the proposed action.

ac = acres; AUMs = animal unit months; kg/hr = kilograms per hour; mi = miles; NO_x = nitrogen oxides; SO_x = sulfur oxides; TSP = total suspended particulates; VRM = Visual Resource Management.

*Only those elements that have impacts that vary significantly from the proposed action are shown.

**Where no entry is made for an alternative, the impact would not vary significantly from that of the proposed action.

***Assumes Enecor would construct small size (2,000 bpsd) project using existing road and power facilities without right-of-way needed for expansion.

TABLE E-2-2

SUMMARY COMPARISON OF IMPACTS BETWEEN PROPOSED POWER TRANSMISSION LINE AND NO-ACTION ALTERNATIVES

Environmental Element*	Paraho Tie Alternative Power Transmission Line	Southern Loop Power Transmission Line	No-Action Alternative***
Air Quality	**	**	40% less impact than proposed action
Water Resources	**	**	2,000 ac-ft/yr reduction in flow of White and/or Green Rivers (.04% of average Green River flow)
Vegetation, Soils, and Reclamation	33 ac less disturbed	69 ac more disturbed	**
Wildlife	33 ac less disturbed habitat	69 ac more disturbed habitat	**
Agriculture	1 AUM more grazing	6 AUMs less grazing	**
Visual Resource	12 ac more VRM Class II affected	**	**
Land Use Plans	most of transmission line within BLM planning corridor 1.0 mi in White River BLM protected zone	most of transmission line within BLM planning corridor 1.0 mi in White River BLM protected zone	no new roads, pipelines or transmission lines

NOTE: Figures are the projected change to baseline due to development of the Enercor project.

When "more" or "less" appears in the description of alternative impacts, impacts are being compared to comparable components or processes of the proposed action.

ac = acres; AUMs = animal unit months; mi = miles; VRM = Visual Resource Management.

*Only those elements that have impacts that vary significantly from the proposed action are shown.

**Where no entry is made for an alternative, the impact would not vary significantly from that of the proposed action.

***Assumes Enercor would construct small size (2,000 bpsd) project using existing road and power facilities without rights-of-way needed for expansion.

The affected environment for the Enercor Rainbow Project (Rainbow) is that part of the existing environment that would be affected by the proposed action (including all project components identified in Chapter E-1) or alternatives. The effects of the project components and the construction and operation work forces on the environment were analyzed for the same resources as identified for the regional analysis (Chapter R-3, Introduction). This chapter provides information only about the environment that would be significantly affected by the Rainbow project as determined by the impact analysis presented in Chapter E-4. Analysis indicated that several resources would not be significantly affected by the Rainbow project. Therefore, descriptions of the following resources were not included:

- Paleontology
- Wilderness - no Wilderness Areas or any areas under formal wilderness review, study, or appeal would be directly or indirectly affected by the Rainbow project or any of its alternatives.

E-3.A PROPOSED ACTION

E-3.A.1 SOCIOECONOMICS

The Enercor Rainbow project primarily would affect Uintah and Duchesne counties. The Colorado area and Uintah and Ouray Indian Reservation would also be affected, but minimally. The present and future baseline conditions for the area of influence is included in Section R-3.A.1, Socioeconomics.

E-3.A.2 AIR QUALITY

The Rainbow plant site would be located just west of Three Mile Canyon at approximately 7,000 feet mean sea level (MSL). Local drainage winds are to the north down Three Mile Canyon into Evacuation Creek. The prevailing winds are from the west. Baseline air quality levels and the National Ambient Air Quality Standards (NAAQS) appear in Table E-4-2, (Section E-4.A.2). As shown on the table, no NAAQS violations are likely to occur under baseline conditions. Visibility measurements taken at Dinosaur National Monument are presented in Section R-3.A.2, Air Quality.

E-3.A.3 WATER RESOURCES

The surface water, floodplains, and ground water that would be affected by the Rainbow project are described in Section R-3.A.3, Water Resources.

E-3.A.4 VEGETATION AND SOILS

The proposed project area is located in a climatic setting with an average annual precipitation of 10 to 14 inches and an average frost-free season of 90 to 110 days. The proposed off-site utility rights-of-way that extend northward are mainly in a climatic setting with annual precipitation of 5 to 8 inches and a 110- to 125-day average frost-free season.

Vegetation

Vegetative cover on the lease areas is of the pinyon-juniper type. The proposed utility rights-of-way area extending north from the Rainbow site changes from the pinyon-juniper type of vegetation to the mixed-desert shrub type. For a description of vegetative types and their species composition, refer to Section R-3.A.4, Vegetation and Soils. The geographic locations of the vegetative types and plant communities are shown on Figure R-3-1 in that section.

Soils and Reclamation

Soils within the project area are mainly shallow to moderately deep, moderately alkaline, loamy upland soils with moderately thick, dark surface layers containing varying amounts of rock fragments which are underlain by hard sandstone and shale. They are on strongly sloping to steep ridges and sideslopes associated with a well defined dendritic drainage pattern. Deep loamy soils occupy the lower lying toe slopes and the narrow, elongated floodplains. Soils which would be within the off-site utility rights-of-way extending northward, are mainly shallow to moderately deep, moderately to strongly alkaline, loamy upland soils having thin surface layers with inherent low fertility and which contain varying amounts of rock fragments. These soils are on strongly sloping to very steep ridges, sideslopes, and hills. A soil survey (order 3) has been made of the project area (SCS and BLM 1981).

Native perennial vegetative cover is difficult to reestablish due to low precipitation, variable soil depths, and unfavorable soil properties, and slope.

E-3.A.5 WILDLIFE

Habitat Types

There are two primary wildlife habitat types found on the project area; the mixed-desert shrub and pinyon-juniper types (see Section R-3.A.4, Vegetation and Soils, for a description of plant communities and species composition in these types).

There are approximately 147 acres of mixed-desert shrub and 1,590 acres of pinyon-juniper found on the project area.

Terrestrial Wildlife

The entire project area is classified as critical mule deer winter range (Utah Division of Wildlife Resources 1982). The project area is also classified as high priority elk (Wapiti) winter range.

The only game bird of any importance found on the project area is the mourning dove. The chukar partridge was introduced into the general project area many years ago, but is now apparently absent. The Utah Division of Wildlife Resources plans to reintroduce this game bird into the general area in the near future.

Raptors common to the project area include red-tailed hawks, golden eagles, prairie falcons, marsh hawks, and American kestrels. The shallow, sage-covered draws in this area furnish habitat for ground-nesting raptors such as marsh hawks and ferruginous hawks. The entire area, however, furnishes hunting habitat for all species of raptors. There are no known raptor nests on the project area.

The species of nongame mamals, nongame birds, and reptiles and amphibians that could be found on the project area are similar to those found throughout the Uintah Basin. Refer to Section R-3.A.5, Wildlife, for a discussion of these species.

Threatened or Endangered Species

The U.S. Fish and Wildlife Service indicates that several federally listed species could occur on the project area (Table R-3-11 and Appendix R-K).

E-3.A.6 AGRICULTURE

Cropland

There would be no cropland located within the lease areas or within any of the utility rights-of-way of the proposed action.

Cropland, including prime agricultural land, located in the Ashley Valley-Jensen and Rangely areas would be affected by the conversion of land to homesites and related urban development in order to accommodate the anticipated increased population from the Rainbow project. For a description of croplands that would be affected, refer to Section R-3.A.6, Agriculture.

Grazing

Livestock grazing is authorized on all lands to be occupied by the proposed project. The BLM has established grazing allotments including the state leased lands and private lands which are administered under an exchange of use agreement by the BLM. Elements of the proposed action would cross ten BLM

grazing allotments containing 49,770 AUMs of forage. These allotments support approximately 9,950 livestock for a 5-month grazing season.

E-3.A.7 TRANSPORTATION NETWORKS

The transportation networks that would be affected by the Rainbow project are described in Section R-3.A.7, Transportation Networks.

E-3.A.8 RECREATION

There are no developed outdoor recreation facilities or intensively used outdoor recreation use areas within the proposed project area. The types and amount of this type of recreation use occurring in Uintah County, which includes the project area, is provided in the Section R-3.A. , Recreation.

Undeveloped-type recreational opportunities within the proposed project area are limited due to the low quality of the recreation resource. Some off-road vehicle (ORV) use and dispersed recreation use (camping, sightseeing, hiking family woodcutting, and Christmas tree cutting) occur in the affected area. However, the amount of use is unknown. Some deer and small game hunting occurs on the proposed plant and mine site. Deer and antelope hunting occurs along the canyon bottom of the White River, which would be crossed by the proposed water pipeline. A small amount of fishing, primarily for channel catfish, also occurs in this river crossing area. As described in Section R-3.A.8, Recreation, the White River is currently on the Nationwide Rivers Inventory, Phase I list (HCRS 1981).

The municipal and county recreation facilities that could be affected by implementation of this project are described in Section R-3.A. , Recreation.

E-3.A.9 CULTURAL RESOURCES

The Rainbow project lies within the Uintah Basin of the Colorado Plateau. The general prehistory and history of the Uintah Basin is contained in Section R-3.A.10, Cultural Resources. None of the Rainbow project area has been surveyed for cultural resources. Therefore, it is not known if any significant resources occur in the proposed project area.

E-3.A.10 VISUAL RESOURCES

The proposed project would be developed within the Colorado Plateau physiographic province. The local landform is mostly a desert plateau with low rolling hills and occasional deep drainage patterns segmented by the White River. Vegetation consists of scattered pinyon-juniper and mixed-desert shrub with interspersed riparian zones. The area is generally uninhabitated and contains a low degree of cultural modifications, except for the Atchee Ridge Road.

The project area consists of three VRM classes. Class II extends along the White River for approximately 1 mile on either side of the river. Class III extends along the Green River for approximately 1 mile on either side of the river. The remainder of the project area is categorized as VRM Class IV (BLM 1981a). Refer to Appendix R-H, Visual Resource Management Methodologies, for an explanation of VRM classes.

The project would affect the existing visual environment in only a limited number of areas, because the area is generally unseen from highly sensitive areas other than along the White River. The section of the Atchee Ridge Road that crosses the area is of low sensitivity. To summarize, approximately 15 acres of VRM Class II area would be affected by the proposed action. Refer to Section R-3.A.11, Visual Resources, for an explanation of the methodology used to determine areas in which the visual resources would be affected.

Existing visibility conditions are discussed in Section E-4.A.2, Air Quality.

E-3-A.11 MINERAL AND ENERGY RESOURCES

The mineral and energy resources underlying the 1,280-acre lease areas are similar to those found throughout the Uintah Basin. These resources are identified in Section R-3.A.13, Mineral and Energy Resources.

E-3.A.12 EXISTING LAND USE PLANS

The land use constraints for the Enercor Rainbow project area are summarized in Section R-3.A.14, Existing Land Use Plans.

E-3.B ALTERNATIVES

The affected environment for all the alternatives to the Enercor Rainbow Project would be essentially the same as described for the proposed action. The acres of land that would be affected by each alternative are listed on Table E-1-2, Section E-1.F.

The project area consists of three VRM classes. Class II extends along the White River for approximately 1 mile on either side of the river. Class III extends along the Green River for approximately 1 mile on either side of the river. The remainder of the project area is categorized as VRM Class IV (BLM 1981a). Refer to Appendix B-H, Visual Resource Management Methodologies, for an explanation of VRM classes.

The project would affect the existing visual environment in only a limited number of areas, because the area is generally unseen from highly sensitive areas other than along the White River. The section of the Atchee Ridge Road that crosses the area is of low sensitivity. To summarize, approximately 15 acres of VRM Class II area would be affected by the proposed action. Refer to Section A-3.A.11, Visual Resources, for an explanation of the methodology used to determine areas in which the visual resources would be affected.

Existing visibility conditions are discussed in Section E-3.A.4, Air Quality.

E-3.A.11 MINERAL AND ENERGY RESOURCES

The mineral and energy resources underlying the 1,280-acre lease areas are similar to those found throughout the Uintah Basin. These resources are identified in Section B-3.A.13, Mineral and Energy Resources.

E-3.A.12 EXISTING LAND USE PLANS

The land use constraints for the Enercor Rainbow project area are summarized in Section B-3.A.14, Existing Land Use Plans.

E-3.B ALTERNATIVES

The affected environment for all the alternatives to the Enercor Rainbow Project would be essentially the same as described for the proposed action. The acres of land that would be affected by each alternative are listed on Table E-1.2, Section E-1.F.

Environmental consequences are those impacts resulting from implementing the proposed action or any of the alternatives. In this chapter, impacts are discussed in a level of detail that corresponds to the severity of impact. Thus, the most significant impacts are discussed in the most detail. The following resources would not be significantly affected by the proposed action or alternatives and, therefore, are not discussed further.

- Paleontology
- Wilderness - no Wilderness Areas or any areas under formal wilderness review, study, or appeal would be directly or indirectly affected by the proposed action or alternatives.

E-4.A PROPOSED ACTION

E-4.A.1 SOCIOECONOMICS

Development of the Rainbow project would cause the population in Uintah and Duchesne counties and the Colorado area to increase by 852 people in 1985 (peak construction) and 941 people in 1995.

None of the counties would be significantly affected by development of the project. Uintah County would experience the most increase, with an increase in population of 2.3 percent (613 people) in 1984 and 2.7 percent (704 people) in 1985. Duchesne County's increase would be negligble, as would the increase in the Colorado area.

The only community that would experience measurable impacts would be Vernal; these would be quite small in comparison to the regional analysis. In 1984, population increases over baseline would be 298 persons, which is 2.9 percent over baseline. In 1985, the increase over baseline would be 344 persons, which is 3.7 percent higher than the baseline.

Employment impacts would also be very small. Again, Uintah County would experience the greatest increase, with a 3.6 percent increase in 1984 and a 4.5 percent increase in 1985.

Total personal income produced by the Rainbow project would be $12.9 million (1980 dollars) in 1984 and $13.7 million in 1985. Most of the income benefits would be experienced by Uintah County and the community of Vernal

Because population increases from the development of the Rainbow project would be small, housing, health, and municipal impacts also would be expected to be relatively small. For a more detailed discussion of the socioeconomic impacts of the Rainbow project, refer to the Socioeconomics Technical Report (State of Utah 1982b).

Quality of Life

The local social consequences associated with the implementation of this proposal would be significant in Uintah County, Utah. The changes would be similar to those discussed under High-level Scenario (Section R-4.A.1), but these effects would be of a lesser scale and intensity.

Uintah and Ouray Indian Reservation

The Rainbow project would be located about 90 miles (by road) from the Uintah and Ouray Indian Reservation. Impacts to the Ute Tribe from this project along would be very marginal and in some cases non-existent. A minor amount of secondary effects from employment opportunities and regional economic influences could be felt, but these would be insignificant. Section R-4.A.1, Socioeconomics, discusses the nature of these impacts, but they would be much less in magnitude for the Rainbow project alone.

E-4.A.2 AIR QUALITY

As indicated in Table E-4-1, increased total suspended particulates and sulfur dioxide concentrations would be within the prevention of significant deterioration (PSD) incremental limitations. Total pollutant concentrations would be within the National Ambient Air Quality Standards (NAAQS), as shown in Table E-4-2. The Air Quality Technical Report (System Applications Inc. 1982) contains isopleths of increased maximum 3-hour, 24-hour, and annual average sulfur dioxide concentrations and 24-hour and annual total suspended particulates concentrations.

The potentials for atmospheric discoloration at Dinosaur National Monument and the Uintah and Ouray Indian Reservation were calculated. The results showed that discoloration due to emissions from the Rainbow project would not be perceptible at these areas. However, yellow-brown atmospheric discoloration as a result of nitrogen oxides emissions may be visible in the vicinity of the falicity during certain conditions (generally clear, stable mornings with light winds). Additional visibility analyses indicated that reduction in visual range would not be significant at any potential or existing Class I areas based on the significance criteria given in Chapter R-4. For more detailed information on the visibility analysis, refer to Appendix R-G or the Air Quality Technical Report (Systems Applications Inc. 1982).

E-4.A.3 WATER RESOURCES

Surface Water

The Rainbow project operation would be a zero discharge process; therefore, the processing facilities would not alter the quality of any surface water supply. However, erosion during construction and from the surface mine would contribute additional sediment to streams. This would be a temporary and insignificant impact. (See Section E-4.A.4, Vegetation, Soils, and

TABLE E-4-1

COMPARISON OF MAXIMUM INCREASED POLLUTANT CONCENTRATIONS
WITH PSD INCREMENTAL LIMITATIONS

	SO_2 Concentration[a] (ug/m^3)			TSP Concentration[a] (ug/m^3)	
PSD Increments/Increment Consumption	3-Hour Average	24-Hour Average	Annual Average	24-Hour Average	Annual Average
Class II Areas					
Allowable PSD Class II increment	512	91	20	37	19
Rainbow increment consumption	12	3	0	7	0
Increment consumption including baseline	13	3	0	7	0
Rainbow increment consumption at Uintah and Ouray Indian Reservation	0	0	0	0	0
Increment consumption at Uintah and Ouray Indian Reservation including baseline	6	1	0	1	0
Class I Areas					
Allowable PSD Class I increment	25	5	2	10	5
Increment consumption at Flat Tops Wilderness Area (federal Class I)					
Rainbow increment consumption	0	0	0	0	0
Increment consumption including baseline	0	0	0	0	0
Increment consumption at Maroon Bells-Snowmass Wilderness Area (federal Class I)					
Rainbow increment consumption	0	0	0	0	0
Increment consumption including baseline	0	0	0	0	0

TABLE E-4-1 (Concluded)

COMPARISON OF MAXIMUM INCREASED POLLUTANT CONCENTRATIONS WITH PSD INCREMENTAL LIMITATIONS

	SO_2 Concentration[a] (ug/m^3)			TSP Concentration[a] (ug/m^3)	
PSD Increments/Increment Consumption	3-Hour Average	24-Hour Average	Annual Average	24-Hour Average	Annual Average
Increment consumption at Colorado National Monument (Colorado Category I and potential federal Class II)					
Rainbow increment consumption	0	0	0	0	0
Increment consumption including baseline	2	0	0	0	0
Increment consumption at Colorado National Monument (Colorado Category I and potential federal Class II)					
Rainbow increment consumption	0	0	0	0	0
Increment consumption including baseline	0	0	0	0	0

Note: For more information on the models used in this analysis, refer to Appendix R-G.

SO_2 = sulfur dioxide; TSP = total suspended particulates; ug/m^3 = micrograms per cubic meter.

[a]Calculated using SAI Gaussian Puff Model with 5-kilometer grid spacing.

TABLE E-4-2

COMPARISON OF MAXIMUM GROUND-LEVEL POLLUTANT CONCENTRATIONS WITH THE NATIONAL AMBIENT AIR QUALITY STANDARDS (NAAQS)

Pollutant / Averaging Time	Maximum Ground-Level Concentration (ug/m^3)			NAAQS (ug/m^3)
	Baseline[a]	Rainbow Impact[b]	Total[c]	
Sulfur dioxide (SO_2)				
3-Hour	4	12	16	1,300
24-Hour	1	3	4	365
Annual	0	0	0	80
Total suspended particulate (TSP)				
24-Hour	140	7	147	150
Annual	35	0	35	60
Nitrogen dioxide (NO_2)				
Annual	1	0	1	100
Carbon monoxide (CO)				
1-Hour	200	1	201	40,000
8-Hour	200	1	201	10,000
Ozone (O_3)				
1-Hour	70	2	72	240
Hydrocarbons (HC)				
3-Hour	100	1	101	160

Note: For more information on the models used in this analysis, refer to Appendix R-G.

ug/m^3 = micrograms per cubic meter.

[a]CO, HC, and O_3 estimated from air quality monitoring data; TSP estimated from Empirical Model; SO_2 and NO_2 estimated from dispersion modeling.

[b]Calculated using SAI Gaussian Puff Model with 5-kilometer grid spacing.

Reclamation, for additional discussion of erosion impacts and the applicant's proposed reclamation plan.) The 5,000 ac-ft/yr that Enercor proposes to withdraw from the White River represents 1 percent of the average annual flow and 0.1 percent of the average annual flow of the Green River. Withdrawal of these amounts would not represent significant impacts.

Floodplains

Impacts to floodplains are discussed in Section R-4.A.3, Water Resources.

Ground Water

Because no aquifers are known to occur in the overburden of the mine area, the Rainbow project would not cause impacts to ground water.

E-4.A.4 VEGETATION, SOILS, AND RECLAMATION

The acreages of vegetation and soils that would be disturbed by construction and surface mining and occupied by the proposed and alternative project facilities are listed in Table E-4-3.

Construction of surface facilities and roads would remove 214 acres of pinyon-juniper type vegetation and 33 acres of mixed-desert shrub type from production for the life of the project (20 years). The open pit mine would remove 1,200 acres of pinyon-juniper type vegetation over the life of the project, or an average of 85 acres per year.

Temporary or short-term disturbance of 294 acres, consisting of 180 acres of pinyon-juniper and 114 acres of mixed-desert shrub vegetation, would occur through construction of pipelines, power transmission lines, and roads, as well as small areas adjacent to buildings and the temporary processed tar sand piles.

A total of 1,594 acres of pinyon and juniper trees removed during construction and operation would be equivalent to a loss of approximately 8,000 cords of fuel wood. The actual value of the wood would be $32,000 if the same area would be clear cut and sold at the BLM individual wood permit price of $4.00 per cord (BLM 1981b). This would amount to a one-time loss for the life of the project. However, the applicant would be required to purchase the wood on public land at fair market value.

Soils and Reclamation

Soil loss resulting from accelerated wind and water erosion caused by construction of linear corridor facilities would occur until erosion control measures are implemented (1 year). Soil loss is expected to be minimized with implementation of effective erosion control and reclamation procedures outlined by the applicant (Appendix R-J). However, impacts to soils would be

TABLE E-4-3

SURFACE AREA DISTURBED, OCCUPIED, RECLAIMED AND EFFECT ON GRAZING AND CROPLAND BY PROJECT COMPONENT

Project Components	Area Disturbed (Total)[a] (Miles)	Area Disturbed (Total)[a] (Acres)	Area Occupied (Project Life)[b] (Acres)	Area Reclaimed and Revegetated[c] (Acres)	Potential Grazing Losses[d] (AUMs[e])	Potential Grazing Losses[d] Livestock (Numbers[f])	Cropland Affected (Acres)	Prime Agricultural Affected (Acres)
Proposed Action:								
Plant Site and Related Facilities[g]	NA	25	25	0	2	0	0	0
Mine Area (Open Pit)[h]	NA	1,200	600	1,200	80	16	0	0
Disposal Area	NA	NA	NA	NA	NA	NA	NA	NA
Roads (Access)	25.0	182	182	0	30	6	0	0
(Mine Haul Road)	3.0	36	36	0	3	1	0	0
Water Pipeline	18.0	109	0	109	7	1	0	0
Power Transmission Line	28.5	185	0	185	11	2	0	0
Product Pipeline	NA	NA	NA	NA	NA	NA	NA	NA
Communication (Telephone)[i]	NA	NA	NA	NA	NA	NA	NA	NA
Off-Site Urban Development[j]	NA	NA	NA	NA	NA	NA	207	62
Totals	74.5	1,737	843	1,494	133	26	207	62
Alternatives:								
White River Section 12, Range 23 East Water Supply System	20.0	121	0	121	8	2	0	0
Green River Water Supply System	28.5	173	0	173	11	2	0	0
White River Section 12, Range 24 East Water Supply System	18	109	0	109	7	2	0	0
Green River Southern Loop Water Supply System	35	212	0	212	14	3	0	0
Paraho Tie Power Transmission Line	21	152	0	152	10	2	0	0
Southern Loop Power Transmission Line	35	254	0	254	17	4	0	0

Note: NA=Not Applicable.

[a]Refer to Table E-1-1 for miles and acres by land ownership.

[b]Project life is 20 years.

[c]Considered temporary disturbance, with exception of the mine area.

[d]Forage losses are considered only for long-term occupancy of grazing land. Linear construction disturbance would be revegetated. No grazing losses would occur unless right-of-way would be fenced.

[e]AUMs computed as an average of 15 acres per AUM for all land ownerships.

[f]Livestock numbers are based upon a 5-month grazing season. One unit = 1 cow or 1 horse or 5 sheep (Source, BLM grazing records, Vernal, Utah).

[g]Includes small stockpile areas.

[h]Mining operation would expose pit area at a rate of 55 to 85 acres per year.

[i]Run in conjunction with transmission line.

[j]Cropland converted to urban uses due to project-related population increases in the Ashley Valley-Jensen area.

significant if applicable erosion control measures are not implemented due to lack of compliance with approved plans or if adverse weather conditions (mainly heavy rainstorms) would occur during construction before any erosion control measures could be installed.

Understory vegetation is expected to return to near preconstruction densities within 3 to 10 years after implementing reclamation measures; however, some vegetation cover would be expected to become established within 3 to 5 years. It would require from 20 to 75 years for brush and up to 300 years for tree species to attain preconstruction dimensions species and densities. With successful implementation of Enercor's reclamation plan, impacts to vegetation would be negligible. However, in the event of unfavorable climatic conditions, establishment of weed species would occur. Establishment of native grasses and shrubs would then be difficult due to competition for moisture and nutrients.

Surface mining activities would affect soils by altering existing soil characteristics and properties, changing topography, and exposing unsuited plant growth materials.

Reclamation of the surface mine area would be accomplished in stages concurrent with project operations. Due to physical and chemical properties, much of the overburden and the processed sand would be generally unsuited for supporting plant growth without treatment. According to the Enercor reclamation program, agronomic reclamation treatments, including topsoil replacement, would be employed to condition the surface of the mine area, make it suitable for plant growth, and control surface runoff and erosion (Appendix R-J). Vegetative cover would be expected to become reestablished within 3 to 10 years.

Impacts to soils would be considered temporary and insignificant except for a few small localized areas consisting mainly of abrupt steep slopes along the linear facility rights-of-way and small areas within the surface mine area that would require continuing follow-up measures.

E-4.A.5 WILDLIFE

Habitat

This project would result in both direct and indirect losses of wildlife habitat. Direct losses of habitat as a result of project construction and operation would total an estimated 1,737 acres (Table E-4-3). Of this, an estimated 243 acres would be lost for the life of the project, which is less than 1 percent of the habitat available in this area. Habitat would also be lost in those areas that are not physically destroyed or modified, but which are close enough to project facilities to become temporarily unusable by wildlife because of dust, noise, and other human disturbances. Reliable estimates of these acres cannot be made at present levels of knowledge.

The 1,494 acres that would be reclaimed would be seeded to a mixture of grass and shrubs adapted to the area. The grasses would probably be established in

3 to 5 years, while the shrub species could take 20 years or more to become established. Thus, the nearly pure grass stand that occurs at initial establishment would change the vegetative character of the area and could induce grass habitat species to infiltrate into an area where they presently do not occur.

Impacts to vegetative habitats incurred during peak construction (1984) and peak operation (1985) are not expected to differ perceptibly. No difference in adverse impacts to wildlife habitat are anticipated between the two peak periods.

Wildlife Populations

Wildlife populations within the project area could be lost or reduced with the advent of this project. Losses could be caused directly by project construction and operation, or indirectly by poaching, wanton killing, collecting, and similar activities.

Harassment from construction and operation activities in critical mule deer winter range could cause a population reduction through abortions or through the deaths of adult deer (Geist 1974). The permanent loss of about 243 acres of critical mule deer winter range in this area (218 acres from rights-of-way and 25 acres from the lease area) would amount to about 0.1 percent of this class of habitat, based upon winter range maps furnished by the Utah Division of Wildlife Resources (1981a). This small reduction in carrying capacity is not anticipated to have an adverse effect upon the native deer population.

Project activities in the high priority elk winter range could also cause stress to wintering animals with a possible loss of production. This disturbance on an estimated 1,737 acres (218 acres from rights-of-way and 1,519 acres from the lease area) would amount to an estimated 0.6 percent of the high priority elk range available in this area. However, since elk tend to avoid human activities, they may move considerable distances in this area to escape, rendering large acreages unusable (UDWR 1981a).

Removal of topsoil and storage for later reclamation, construction of ancillary facilities, and upgrading of access roads would cause direct mortality to small burrowing rodents. These losses would be heavy and long term on the estimated 243 acres to be covered by surface facilities; losses on 1,494 acres which would be temporarily disturbed would be heavy but short term because of the rapid and high reproductive potential of these species. The revegetation of the temporarily disturbed areas to a grass complex could result in a different small mammal population, since small rodents that frequent the mixed-desert shrub habitat might not return to an area planted to grass (BLM 1978c).

Mourning doves feed and nest on most of the proposed project area, but the habitat is marginal because of the uniformly poor quality of habitat throughout the area. No data exist on nesting dove populations, but about 843 acres of poor quality nesting and feeding habitat would be lost for the life of the project (20 years). This loss of habitat and its estimated dove

production is estimated to equal less than 1 percent of the total Uintah County dove population.

The new populations of chukar partridges to be transplanted into this area by the Utah Division of Wildlife Resources would be extremely vulnerable to poaching during the first 3 years after the transplant. A population reduction or possible extermination could occur as a result of poaching during the time the bird population is trying to establish itself.

Some small nongame songbirds would be lost or displaced by the loss of 1,737 acres of mixed-desert shrub and pinyon-juniper habitat. Since the best data indicate that there are an average of about 21 breeding pairs of small birds per 100 acres (BLM 1978), a theoretical population loss of 357 breeding pairs could be expected from project construction and operation. It is anticipated, however, that these losses would be less than 1 percent of the Uintah County small bird population.

Raptors could be adversely affected by this project by the elimination of about 243 acres of prey habitat for the life of the project. Ground nesting raptors such as marsh hawks and ferruginous hawks would also lose nesting habitat for the same period of time. Losses of raptors are not expected to be significant, however, as there appears to be ample foraging and nesting habitat throughout the areas adjacent to the project area.

Direct losses of reptiles on an estimated 243 acres of habitat for the life of the project and displacement on the same number of acres would total an estimated 1 percent or less of the regional population. Reproduction in these species is high enough so that repopulation would be rapid once the project is abandoned.

E-4.A.6 AGRICULTURE

Cropland

Project-related population increases and associated support facilities would cause the conversion of an estimated 207 acres of cropland, including prime agricultural land, to homesites and other related urban development in the nearby areas of Ashley Valley and Rangely (Table E-4-3, Section E-4.A.4). This land use conversion would contribute to the loss of cropland in the region, as discussed in Section R-4.A.6, Agriculture. No cropland would be affected by the construction or operation activities within the lease area or facility rights-of-way.

Grazing

The proposed project would remove 1,737 acres of vegetation and its productive capacity for various periods of time. Where there are surface structures, an additional 3 to 20 years after project abandonment would be required to bring the land to preconstruction conditions. Construction of linear rights-of-way would disturb 294 acres of vegetation. The productive capacity of the rights-

of-way would be lost during the 1-year construction period but would be expected to be restored to preconstruction levels within 5 to 10 years after implementation of the reclamation plans outlined by the applicant. Surface mining activity would disturb 1,200 acres which would be revegetated progressively at the rate of 85 acres per year. Livestock grazing would be restricted on the entire area to provide time for vegetation to become established.

Loss of forage due to all construction activities would total approximately 133 AUMs (Table E-4-3, Section E-4.A.4). or 0.2 percent of the carrying capacity of the allotments involved. One allotment, where the processing plant and mined area would be located, would sustain a loss of 52 AUMs, or less than 1 percent of its grazing capacity. Since more than 10 AUMs would be lost on this allotment, reduction in allowable use would be necessary.

Impacts would be insignificant from loss of forage. Secondary impacts from livestock road kills and disruption of grazing patterns from traffic and construction activity could result in conditions that would make grazing on the allotment more difficult.

E-4.A.7 TRANSPORTATION NETWORKS

The Rainbow project would generate a minimum amount of additional traffic on the transportation network. Only U.S. 40 from the county line to County Road 264 would experience an unacceptable level of service. The level of service would be reduced to level D (American Association of State Highway and Transportation Officials 1965). This means traffic flow would fluctuate in volume and would have temporary restrictions to flow, which could cause substantial drops in operating speeds.

The projected traffic volume and level of service analysis for the networks is presented in the <u>Socioeconomics Technical Report</u> (State of Utah 1982b). The largest impact would be from additional truck traffic. Until the water supply system is complete, water trucks would generate the largest number of truck trips. Additional traffic (about 27 truck trips per day) would be generated by trucks transporting supplies such as soda ash, diesel fuel, and crude oil. Most of these trucks would be headed to Vernal, Roosevelt and further west.

E-4.A.8 RECREATION

The implementation of the proposed Enercor Rainbow project would directly disturb 1,737 acres of land from the recreation land base for the life of the project (20 years). Since dispersed recreation opportunities are limited within the project area, there would be relatively little impact upon recreation use.

The project would cause a population increase of 852 people in 1984 (peak construction year) and 941 people in 1985 (peak operation year). Relatively little impact to ORV activities, camping, fishing, hunting, and other day-use

recreational opportunities would occur. No impacts are anticipated upon the recreation opportunities provided by Vernal, Roosevelt, or Rangely due to the small population increase.

The section of the White River from the confluence of the Green River to the Colorado-Utah state line has been identified as a potential candidate for Wild and Scenic River status by the Nationwide Rivers Inventory, Phase I (HCRS 1981a). The proposed water pipeline, which would include a water intake structure, a mud-settling pond, and pump station, and the proposed power transmission line could cause adverse aesthetic impacts on the "natural, cultural, and recreation values" of the White River (Federal Register 1980a). However, since this EIS includes the assumption that the White River dam would be constructed and since the proposed action for the Rainbow project would be to pump water directly from the White River reservoir, the prior impacts of the White River Project would likely eliminate the river from any future consideration as a National Wild and Scenic River, independent from the Rainbow project.

E-4.A.9 CULTURAL RESOURCES

The Rainbow project would cause land modification that could affect cultural resources as described in Section R-4.A.10, Cultural Resources. All rights-of-way and lease areas anticipated to have surface disturbance associated with the proposed action would have to be surveyed and evaluated for significant cultural resources.

E-4.A.10 VISUAL RESOURCES

The visual resources of the areas that would undergo significant adverse impacts as a result of the proposed action and alternatives (including the total number of acres that would be affected) are summarized in Table E-4-4. The placement of the project in these areas would exceed the allowable levels of contrast for each VRM class established for the specific areas within the project area. Areas where impacts would exceed the acceptable levels of contrast for a specified VRM class are placed in VRM Class V (indicating rehabilitation would be necessary). Refer to Section R-4.A.11, Visual Resources, for a description of the criteria used to determine the significance of visual resource impacts from project construction.

E-4.A.11 MINERAL AND ENERGY RESOURCES

Data on net energy requirements for tar sand projects are not available in the literature. Consequently, the net energy analysis done for this project is an approximation and leaves out several components that could be expected to have some effect on overall efficiency, including the materials to be used in the hot-water extractor and the materials and energy required to construct and maintain some 25 miles of road. Partly balancing these, the proposed surface mining typically delivers to the processor 85 percent of the tar sand in the

TABLE E-4-4

SIGNIFICANT ADVERSE VISUAL RESOURCE IMPACTS

COMPONENT	VRM CLASS	ACRES SIGNIFICANTLY AFFECTED	LOCATION AND DURATION OF IMPACTS	EXPLANATION
Proposed Action				
Water Supply System	II	3	Alluvial well system as viewed from the White River for approximately 0.5 mile (long-term); within Right-of-way.	Structural contrast of the well facility. Vegetation contrast where removed for well and pipeline construction.
Power Transmission Line	II	12	Transmission line and vegetation clearing viewed approximately 0.5 mile each side of White River. Communications line also included.	Strong structural contrast of transmission line and communications line for length of project. Contrast in vegetation clearing during construction.
Alternatives				
White River Section 12, Range 23 East Water Supply System	II	6	Alluvial well system as viewed from the White River for approximately 0.5 mile (long-term; within Right-of-way.	Structural contrast of the well facility. Contrast where vegetation removed for well field and pipeline construction.
Green River Water Supply System	III	6	Alluvial well system as viewed from the Green River for approximately 0.5 mile from the Green River (long-term), within Right-of-way.	Structural contrast of the well facility. Contrast where vegetation removed for well field and pipeline construction.
	IV	12	Vegetation clearing seen approximately 0.5 mile each side of County Road "B" (long-term); within Right-of-way.	Contrast where vegetation removed for pipeline construction.
White River Section 12, Range 24 East Water Supply System	II	12	Alluvial well system as viewed from the White River for approximately 0.5 mile (long-term); within right-of-way.	Structural contrast of the well facility contrast where vegetation removed for well field and pipeline construction.
Green River Southern Loop Water Supply System	II	12	Pipeline vegetation clearing as viewed from White River for approximately 0.5 mile each side of river (long-term); within right-of-way.	Vegetation clearing contrast created by pipeline construction.
Paraho Tie Power Transmission Line	II	12	Power transmission lines and vegetation clearing viewed approximately 0.5 mile each side of White River. Communications line also included.	Strong structural contrast of power transmission lines and communication line for length of projects. Contrast in vegetation clearing during construction.
Southern Loop Power Transmission Line	II	12	Power transmission lines and vegetation clearing viewed approximately 0.5 mile each side of White River. Communications line also included.	Strong structural contrast of power transmission lines and communication line for length of projects. Contrast in vegetation clearing during construction.

ground, and the hot-water extractor is reputedly very efficient. It should be borne in mind, however, that the efficiency shown below is approximate.

The methodology used to determine the following figures is discussed in Section R-4.A.13, Mineral and Energy Resources, and Appendix R-L.

	Trillion-Btu's/Year
Net Output	9.570
Energy in Tar Sand	(12.530)
Other Fuels Used	(.618)
Indirect Energy	(2.187)
Infrastructure	(2.745)
Total Input	18.080
Percent Efficiency	52.9%

At almost 53 percent efficiency, the project would be slightly more efficient than a coal-fired electric power plant or than producing oil from a pumped well.

E-4.A.12 EXISTING LAND USE PLANS

The proposed Enercor Rainbow Project would conflict with BLM's Rainbow Management Framework Plan, which states that all rights-of-way on federal land are to be located within corridors. As proposed, the power transmission line (12 miles) and the water pipeline (12 miles) would occur outside of the right-of-way corridor designated by the plan. For land ownership designations, see Table E-1-1 (Section E-1.C.3).

The proposed water pipeline would meet the White River within the W 1/2 Section 11, NW 1/4 Section 14, T. 1 S., R. 23 E. (Map R-A-1). The power transmission line would parallel the White River within the NW 1/4 Section 24, W 1/2 Section 13 and SE 1/4 Section 12, T. 1 S., R. 23 E. This would be in conflict with the management framework plan, which establishes a no occupancy zone (0.5 mile wide, or line of sight) along the Green and White rivers.

Although not presently in conflict, parts of the proposed action may conflict with the Uintah County plan. The project area is currently zoned for mining and grazing in accordance with the Uintah County zoning ordinance, but the county is currently developing a new land use master plan. However, the new plan would likely consider the proposed energy developments and not impose constraints that would ban the orderly development of the Rainbow project.

E-4.B WHITE RIVER SECTION 12, RANGE 23 EAST ALTERNATIVE WATER SUPPLY SYSTEM

Under this alternative, water would still be obtained from the White River (but not directly from the reservoir as under the proposed action), but the pipeline would follow a different route which would be 20 miles long (2 miles longer than the proposed action) and disturb a total of 121 acres (12 more acres than the proposed action).

About 121 acres of vegetation would be disturbed for 3 to 5 years until vegetation is established consisting of 55 acres of pinyon and juniper and 66 acres of desert shrub vegetation types. Reclamation would occur as discussed for the rights-of-way in Section E-4.A.4, Vegetation, Soils, and Reclamation. Approximately 275 cords of fuel wood at a value of $1,100 would be removed through clearing of the right-of-way. The removal of this volume is not considered significant. The applicant would be required to pay fair market price for value of commercial wood products removed from public land during construction. Wood is normally made available to local residents rather than burned or disposed by other methods.

Reclamation would restore the disturbed acreage with a mixture of adapted grasses and shrubs. Establishment of grass cover on the disturbed areas would take 3 to 5 years, with shrub establishment taking about 20 years. No adverse impacts to wildlife are expected from this small area of disturbance.

"Natural, cultural, and recreation values" of the White River would be adversely affected, thereby potentially affecting any future Wild and Scenic River considerations of the White River for a 1-mile segment of the river downstream from the White River Dam.

This alternative would conflict with BLM's Rainbow Management Framework Plan (Section R-3.A.13), because 16 miles of the pipeline would be located outside the designated right-of-way corridor and approximately 3.5 miles would be located within 0.5 mile of the White River which is within the designated protective zone (Map R-A-3).

Effects to socioeconomics, air quality, cropland, transportation networks, recreation, wilderness, cultural resources, visual resources, and mineral and energy resources would be similar to those discussed for the proposed action.

E-4.C GREEN RIVER ALTERNATIVE WATER SUPPLY SYSTEM

Under this alternative, water required for plant operations would be obtained from the Green River and transported via a 28.5-mile long pipeline from the Bonanza Power Plant to the Rainbow project area. As discussed in Section E-4.A.3, the 5,000 ac-ft/yr that Enercor proposes to withdraw from the Green River represents 0.1 percent of the average annual flow of that river; this would not significantly affect the flow or water quality of the Green River. Any reduction in flow of the Green River is predicted to have adverse impacts on the endangered fish species endemic in the Green River (FWS 1982).

About 173 acres of vegetation would be disturbed (80 acres of pinyon-juniper and 93 acres of desert shrub). The period of disturbance would last approximately 3 years, until vegetation is established. Reclamation would occur as discussed for rights-of-way in Section E-4.A.4, Vegetation, Soils, and Reclamation. Approximately 400 cords of fuel wood with a value of $1,600 would be removed through clearing of the right-of-way and purchased. The impact would not be significant. The 173 acres of disturbance would reduce carrying capacity for livestock by 11 AUMs. This amount would be insignificant as the loss would be distributed over the 28.5 mile-length of the right-of-way.

The Green River from the confluence with Range Creek to the Yampa River has been identified under the Nationwide Rivers Inventory, Phase I (HCRS 1981). The impacts of this alternative water supply system on the rivers "natural, cultural, and recreation values" would adversely affect a 1-mile segment of the Green River due to the pump station, and this could affect any future consideration for Wild and Scenic River studies. This alternative would conflict with BLM's Rainbow Management Framework Plan (Section R-3.A.13, Existing Land Use Plans) because about 21 miles would be located outside the designated right-of-way corridor and because it would be located within 0.5 mile of the White River (White River crossing) a designated protective zone (Section E-3.A.11).

Effects to socioeconomics, air quality, cropland, transportation networks, recreation, wilderness, cultural resources, visual resources and minerals and energy resources would be similar to those discussed for the proposed action.

E-4.D **WHITE RIVER SECTION 12,RANGE 24 EAST ALTERNATIVE WATER SUPPLY SYSTEM**

Under this alternative, water would be diverted from a different point along the White River than the proposed action. Most of the pipeline route would lie within a BLM-proposed utility corridor (Map R-A-4, located in Appendix R-A), so there would be no conflicts with existing land use plans. The length of the pipeline would be the same as the proposed action and would disturb the same acreage as the proposed action.

The utilization of 5,000 acre-feet per year from the White River via this alternative is estimated to reduce the average annual flow of the river by about 1.0 percent. Any reduction in flow in the White River is anticipated to cause adverse impats to the endemic endangered fish species (FWS 1982).

Because the land that would be affected by this alternative does not vary significantly from the land affected by the proposed action, impacts from this alternative would be similar to those of the proposed action for socioeconomics, air quality, vegetation, soils, cropland, livestock grazing, transportation networks, recreation, wilderness, cultural resources, and visual resources.

E-4.E GREEN RIVER SOUTHERN LOOP ALTERNATIVE WATER SUPPLY SYSTEM

Under this alternative, water would be obtained from the Bonanza Power Plant from the Green River and transported via a 35-mile long pipeline to the Rainbow plant site. Most of the pipeline would lie within a BLM-proposed corridor (Map R-A-4, located in Appendix R-A), so it would not conflict with any existing land use plans. As discussed in Section E-4.A.3, the 5,000 ac-ft/yr that Enercor proposes to withdraw from the Green River represents 0.1 percent of the average annual flow of that river; this would not significantly affect the flow or water quality of the Green River. Any reduction in flow of the Green River is predicted to have adverse impacts on the endangered fish species endemic in the Green River (FWS 1982).

About 212 acres of land would be disturbed by constrution of the water pipeline for 1 year. Because that land that would be affected does not vary significantly from the land that would be affected by the Green River Alternative Water Supply System (north of the White River) and proposed action (south of the White River), impacts of this alternative would be similar to the applicable portions of the other 2 respective routes for socioeconomics, air quality, vegetation, soils, cropland, transportation networks, recreation, wilderness, cultural resources, and visual resources.

However, because of the greater length of the pipeline, an additional 103 acres of land would be disturbed during construction, so the impacts would be slightly greater in extent. Livestock carrying capacity would be temporarily reduced by approximately 7 AUMs more than the proposed action, but the total 14 AUMs spread over the 35-mile length of the right-of-way would not cause impacts greater than those assessed for the proposed action.

E-4.F PARAHO TIE ALTERNATIVE POWER TRANSMISSION LINE

Under this alternative, a 21-mile long, 138-kV power transmission line would tie to a line proposed by Paraho instead of the proposed action line (Section P-1.D.2). Most of the transmission line route, including the White River crossing, would lie within a BLM-proposed corridor (Map R-A-4, located in Appendix R-A), so it would not conflict with any existing land use plans.

During construction, 152 acres would be disturbed (86 acres of pinyon and juniper and 66 acres of mixed-desert shrub vegetation types). Approximately 400 cords of fuel wood at a value of $1,600 would be removed through clearing of the right-of-way. The removal of this volume is not considered significant. Wood is normally made available to local residents rather than burned or disposed of by other methods. An additional 3 AUMs of forage would be affected by this alternative than by the proposed action, but the total 10 AUMs spread over the 21-mile length of right-of-way would not cause impacts greater than those assessed for the proposed action. Harassment from construction of the power line in both 3 1/2 miles of critical deer summer range and 14 miles of high priority winter range area during critical times fo the year would cause a population reduction through abortion and death of adult deer caused by stress (Geist 1974).

Removal of topsoil around power poles and temporary road construction would cause direct mortaility to small burrowing rodents on an estimated 152 acres of habitat. These losses would be short-term, however, Impacts to mourning doves, small nongame songbirds, reptiles and amphibians on 152 acres would be the same as those noted in the proposed action section.

Effects to socioeconomics, air quality, cropland, transportation networks, recreation, wilderness, cultural resources and visual resources would be similar to those of the proposed action.

E-4.G SOUTHERN LOOP ALTERNATIVE POWER TRANSMISSION LINE

Under this alternative, power would be purchased from the Bonanza Power Plant and transported via a 35-mile long, 138-kV power transmission line. Most of the transmission line route would lie within a BLM-proposed corridor (Map R-A-4, located in Appendix R-A) and would parallel the water pipeline route of the Green River Southern Loop Alternative Water Supply System (Section E-4.E). It would not conflict with any existing land use plans.

About 254 acres of land would be disturbed during construction. Because the land that would be affected by the alternative does not vary significantly from the land that would be affected by the proposed action, impacts of this alternative would be similar to those of the proposed action for socioeconomics, air quality, soils, cropland, transportation networks, recreation, wilderness, cultural resources, and visual resources.

However, an additional 91 acres of mixed desert shrub would disturbed, because the alternative line woudl be 6.5 miles longer. Livestock carrying capacity would temporarily be reduced by approximately 7 AUMs more than the proposed action, but the total 14 AUMs spread over the 35-mile length of the right-of-way would not cause impacts greater than those assessed for the proposed action. The route would cross 3 1/2 miles of critical deer summer range, 14 miles of high priority deer winter range, and 17 1/2 miles of limited value yearlong deer range based upon deer range maps of The Utah Division of Wildlife Resources (UDWR 1981). Impacts to mule deer, as well as all other animal species would be similar to those described for the proposed action.

E-4.H NO-ACTION ALTERNATIVE

Under this alternative, the requested rights-of-way would be denied. Refer to the No-Action Alternative section of the Site-Specific Analyses Introduction of this EIS for an explanation of the purpose of this alternative. A denial would not preclude development of the Rainbow project. However, as described in Section E-1.E.7, the project could only be developed to its initial capacity (2,000 bpsd).

NO-ACTION ALTERNATIVE

Impacts to socioeconomics would be similar to those for the proposed action because the number of employees would be basically the same. Impacts to air quality would be less than for the proposed action. The emission rates would be about 40 percent as much as for the proposed action. Ground-level concentrations would be less than those for the proposed action. No NAAQS or PSD increments would be violated. About 600 acres would be disturbed, including 25 acres for the plant site. Because the land that would be affected by this alternative does not vary significantly from the proposed action, impacts of the alternative would be similar to the proposed action for vegetation, soils, wildlife, cropland, livestock grazing, recreation, wilderness, cultural resources, and visual resources.

Without rights-of-way for the water line and product line, water would be hauled to the site, and oil to the refinery in tank trucks. The reduction in the production level would result in fewer trucks required to haul the oil to local refineries, but with the truck increase from the water hauling, the overall truck traffic would be expected to remain approximately the same as for the proposed action.

In addition, the purpose of the Rainbow project (see Section E-1.A.1) would not be totally achieved. The goal of 5,000 bpsd would not be reached. The full benefits of this project as a commercial demonstration project for the proposed extraction method may not be achieved, because of the shortened project life. This could effect the viability of tar sand extraction in this area.

Impacts to socioeconomics would be similar to those for the proposed action because the number of employees would be basically the same. Impacts to air quality would be less than for the proposed action. The emission rates would be about 40 percent as much as for the proposed action. Ground-level concentrations would be less than those for the proposed action. No NAAQS or PSD increments would be violated. About 140 acres would be disturbed, including 35 acres for the plant site. Because the land that would be affected by this alternative does not vary significantly from the proposed action, impacts of the alternative would be similar to the proposed action for vegetation, soils, wildlife, cropland, livestock grazing, recreation, wilderness, cultural resources, and visual resources.

Without rights-of-way for the water line and product line, water would be hauled to the site, and oil to the refinery in tank trucks. The reduction in the production level would result in fewer trucks required to haul the oil to local refineries, but with the trucks to haul the water to the site, the overall truck traffic would be expected to remain approximately the same as for the proposed action.

In addition, the purpose of the Rainbow project (see Section E.4.1) would not be totally achieved. The goal of 5,000 bpsd would not be reached. The full benefits of this project as a commercial demonstration project for the proposed extraction method may not be achieved, because of the shortened project life. This could affect the viability of tar sand extraction in this area.

E-5.A **CUMULATIVE IMPACTS**

Cumulative impacts result when a new project is developed in an area in which other projects exist or are proposed. Although the impacts from the individual projects might be minor, the impacts from all projects in an area could be significant. The interrelated projects considered in the cumulative impact analysis for the Enercor Rainbow Project are listed in Tables R-1-2 and R-1-3. The projects proposed by the other applicants were not considered here, because the cumulative impacts of all the applicants' project were discussed in Chapter R-4, Regional Environmental Consequences.

The only resources that would sustain significant cumulative impacts from the addition of the Enercor Rainbow Project to the Uintah Basin would be socioeconomics, air quality, wildlife, and agriculture.

E-5.A.1 SOCIOECONOMICS

When adding interrelated projects, Uintah County is the only county that would have any sizeable population or employment increases. Most of these cumulative impacts would be a result of the interrelated projects rather than the Rainbow project. In 1984, the percentage increase in population over baseline for Uintah County would be 9.2 percent (2,487 persons). In 1985, the percentage would be 9.1 percent (2,335 persons). Employment changes in Uintah County would be 15.7 percent (1,822 persons) and 14.8 percent (1,571 persons), respectively. The Colorado area would have minimal population increases. (Although the Rainbow project would be fairly close to the Colorado area, it was assumed that the poor condition of the road between Bonanza and the Colorado state line and Uintah County's non-maintenance policy for this road would preclude commuter travel on the road. Thus, it was assumed that the travelway to Rangely was the Bonanza Road to SR 40 to SR 64. This, in turn, reduced the population allocations to the Colorado area. (Barber 1982))

In terms of communities, Vernal would be the only incorporated community having impacts of any significance. In 1984, the increase over baseline would be 8.1 percent (824 persons). In 1985, the population increase would be 9.8 percent (909 persons).

Housing demand in Uintah County would increase over baseline by 7.2 percent (682 households) in 1985. For 1985, the percentage over baseline would be 8.4 percent (725 households).

Total personal income produced by the Rainbow project plus the interrelated projects would be $66.3 million (1980 dollars) in 1984 and $62.7 million in 1985. Most of the income benefits would be gained by Uintah County and the community of Vernal.

The increases in service demands that would occur in 1984 and 1985 are shown in Table E-5-1.

Uintah and Ouray Indian Reservation

Adding interrelated projects to potential impacts from the Enercor project would substantially increase the potential impacts to the reservation. This is because the impacts from the Enercor project alone are expected to be not very significant given the substantial distance from the reservation. Impacts from the Enercor project and the interrelated projects would be the same as those described in Section R-4.A.1, Socioeconomics. However, impacts would be much less than the cumulative effects from all projects discussed in the regional analysis.

Quality of Life

Population growth levels associated with this level of development would have significant social effects in Uintah County. These effects would be similar in nature, but not at the same order of magnitude as those described under High-level Scenario (Section R-4.A.1).

E-5.A.2 AIR QUALITY

Cumulative PSD increment consumption is compared to the Class I and Class II increments in Table E-5-2, which shows that no violations of PSD incremental limitations would occur. Total ground-level concentrations are compared to the NAAQS in Table E-5-3, which shows that no NAAQS violations would occur.

E-5.A.3 WILDLIFE

The influx of new people into Uintah County due to the Rainbow project and interrelated projects would cause direct and indirect impacts to wildlife. (Uintah County is the only area where cumulative impacts to wildlife as a result of implementing the Rainbow project and interrelated projects are expected to be significant.) Indirect impacts to wildlife caused by an estimated influx of 2,487 new people in 1984 and 2,335 new people in 1985 include, but are not limited to harassment, poaching, and wanton killing, resulting in possible wildlife population reductions. It is estimated that losses from poaching and wanton killings would increase about 9.2 percent by 1984 and by 9.1 percent by 1985 because of the increase in human population.

TABLE E-5-1

CUMULATIVE INCREASES IN SERVICE DEMANDS

Services	Area	Percent Increase Over Baseline 1984	1985
Education	Uintah County		
Teachers		5.5	6.3
Classroom		5.5	6.3
Health	Uintah County		
Physicians		5.7	6.1
Nurses		5.7	6.2
Mental Health	Uintah County		
Psychiatrists		5.9	6.1
Social Workers		5.9	6.0
Law Enforcement	Uintah County		
Police Officers		6.2	7
Police Cars		6.2	7
Sewer (waste flow)	Vernal	8.1	9.8
Water (connections)	Vernal	8.1	9.8

TABLE E-5-2

COMPARISON OF PSD INCREMENTS WITH
CUMULATIVE INCREMENT CONSUMPTION

PSD Increments/Increment Consumption	SO_2 Concentration (ug/m^3)[a]			TSP Concentration (ug/m^3)[b]	
	3-Hour Average	24-Hour Average	Annual Average	24-Hour Average	Annual Average
Class II Areas					
PSD Class II increment	512	91	20	37	19
Cumulative increment consumption	14	3	0	8	0
Cumulative increment consumption at Uintah and Ouray Indian Reservation	14	3	0	3	0
Class I Areas					
PSD Class I increment	25	5	2	10	5
Cumulative increment consumption at Flat Tops Wilderness Aea (federal Class I)	1	1	0	0	0
Cumulative increment consumption at Maroon Bells-Snowmass Wilderness Area (federal Class I)	0	0	0	0	0
Cumulative increment consumption at Dinosaur National Monument (Colorado Category I and potential federal Class I)	6	1	0	1	0
Cumulative increment consumption at Colorado National Monument (Colorado Category I and potential federal Class I)	0	0	0	1	0

Note: Impacts are on lease area; off lease area impacts are within increments.
[a] Calculated using the SAI Gaussian Puff Model with a 5-kilometer grid spacing.
[b] Class II increment calculated using EPA Complex I Model with a 1-kilometer grid spacing; Class I consumption calculated using the SAI Gaussian Puff Model with a 5-kilometer grid spacing.

TABLE E-5-3

COMPARISON OF CUMULATIVE MAXIMUM GROUND-LEVEL POLLUTANT CONCENTRATIONS WITH THE NATIONAL AMBIENT AIR QUALITY STANDARDS (NAAQS)

Pollutant/Averaging Time	Maximum Cumulative Ground-Level/Concentrations (ug/m^3)[a]	NAAQS ug/m^3
Sulfur Dioxide (SO_2)		
3-Hour	17	1,300
24-Hour	4	365
Annual	0	80
Total Suspended Particulates (TSP)		
24-Hour	148	150
Annual	35	60
Nitrogen Dioxide (NO_2)		
Annual	1	100
Carbon Monoxide		
1-Hour	201	40,000
8-Hour	201	10,000
Ozone (O^3)		
1-Hour	72	240
Hydrocarbons (HC)		
3-Hour	101	160

Note: It is conservatively assumed that baseline maximum, Enercor maximum, and interrelated projects maximum all coincide.

ug/m^3 = micrograms per cubic meter

[a] Includes baseline, applicants' facility, and interrelated projects.

Other indirect impacts include an estimated 9.1 percent increase in demand for the opportunity to hunt and fish by 1985. There would also be about a 9.1 percent increase in competition for limited licenses or permits by 1985, which would reduce the chances of local sportsmen obtaining these permits at the same rate they now enjoy.

E-5.A.4 AGRICULTURE

Cropland

Implementation of the proposed Rainbow project along with the interrelated projects would cause a predicted population increase in the Uintah Basin of 2,335 people by the year 1985. This would result in the conversion of an estimated 5,934 acres of cropland, including prime agricultural land, to homesites and other related urban development in the Ashley Valley and Rangely areas. This land use conversion would contribute to the loss of cropland in the region, as discussed in Section R-4.A.6, Agriculture.

DESCRIPTION OF PROPOSED ACTION AND ALTERNATIVES

M-1.A INTRODUCTION

The Magic Circle Energy Corporation (Magic Circle) proposes to construct and operate the Cottonwood Wash Project, a shale oil production facility. The plant site would be located on a 10,254-acre site in Uintah County, Utah. Construction is scheduled to commence in 1983 and would continue through 1989. Limited commercial operation would begin in 1986 with full production of approximately 31,500 barrels per stream day (bpsd) anticipated by 1988. Development of this project would require the issuance of rights-of-way by the Bureau of Land Management (BLM) and the Bureau of Indian Affairs (BIA) with concurrence of the Ute Indian Tribal Council.

There is a potential for a second phase of operation which would utilize the vertical modified in-situ (VMIS) process. If the VMIS process goes into operation, a total output of 100,000 bpsd of shale oil would be anticipated. However, because there is currently no means of knowing whether or when the VMIS process would be applied to the Cottonwood Wash resource, room-and-pillar mining with surface processing of 31,500 bpsd is the basis for evaluating the environmental impacts of the project. No additional information on the VMIS process is presented in this EIS. If implementation of the VMIS process would require a change in the federal rights-of-way or permits evaluated in this EIS, additional environmental assessment would be required when plans for implementation of this process are more completely developed.

This chapter focuses on the impact causing aspects of the proposed project and alternatives to that project. More detailed information about all aspects of the Magic Circle project is included in Commercial Shale Oil Production From the Utah Cottonwood Wash Project (Magic Circle 1982). Copies of this report can be obtained from Mr. Reed Clayson, Synfuels Engineering and Development, P.O. Box 5147, Golden, Colorado 80401. Copies are also available for review in public libraries located in the Uintah Basin and in Salt Lake City and Denver main libraries.

M-1.A.1 PURPOSE AND NEED OF PROPOSED PROJECT

Purpose

The purpose of the Magic Circle project is to produce 31,500 bpsd of shale oil and at least 44 megawatts of exportable electricity.

Need

The need for this project and other proposed synthetic fuel projects in the Uintah Basin is similar. This need is discussed in the Site-specific Analyses Introduction of this environmental impact statement (EIS).

M-1.A.2 LOCATION

The Magic Circle project would be located in Uintah County, Utah, approximately 40 miles south of Vernal via U.S. Highway 40 and State Route 88 (Map R-1-1 in Section R-1.A).

M-1.A.3 AUTHORIZING ACTIONS

To implement the Magic Circle project, certain federal, state, and local authorizing actions would have to be taken. Most of the actions required to authorize the various synfuel projects in Uintah County would be similar; these are identified in the Site-Specific Analyses Introduction of this EIS. The specific BLM actions required for authorization of the Magic Circle project would be granting the following rights-of-way across federal land:

- 0.75 miles for access road
- 2 miles for water pipeline
- 5 miles for power transmission line
- 24.5 miles for two product pipelines

Magic Circle has applied for all these rights-of-way.

M-1.A.4 INTERRELATIONSHIPS WITH OTHER PLANNED PROJECTS AND SPECIAL MANAGEMENT AREAS

Projects

The interrelated projects that occur in the area of influence of Uintah Basin synfuels shale development are shown in Tables R-1-2 and R-1-3 in Section R-1.A.

Special Management Areas

Approximately 10 miles of the proposed water pipeline and 29 miles of the proposed product pipeline to Roosevelt, Utah, would cross lands of the Uintah and Ouray Indian Reservation and would require approval by the Ute Indian Tribal Council.

M-1.B **HISTORY AND BACKGROUND**

M-1.B.1 LEASES

Magic Circle Energy Corporation was granted a lease for 6,400 acres from the State of Utah in 1975 under a Unit Agreement and Cooperation Plan of Development. Additionally, Magic Circle has formally requested that the State of Utah exchange state-owned lands for BLM lands adjacent to Magic Circle's existing state-leased holdings, which would increase these holdings to 10,254 acres (see Map M-1-1). This land trade was approved by the Utah State Land

Board in 1981; however, the exchange between the State and BLM is pending. BLM plans to prepare an Environmental Assessment on the proposed land exchange, pending the outcome of the Minerals Management Service resource valuation studies.

M-1.B.2 PERMITS

In 1966, parties now associated with Magic Circle applied to the Utah Division of Water Resources for a permit to obtain up to 14,000 acre-feet per year (ac-ft/yr) of water from the Green River. An application for 7,000 ac-ft/yr of water from the White River was filed in 1981. The 1966 application has been amended to allow an earlier utilization of approximately 2,000 ac-ft/yr. Action on this amended application is pending. Regardless of the amount of water that Magic Circle has applied for, the company plans to use 540 ac-ft/year for the Cottonwood Wash Project at full production.

M-1.C OVERVIEW OF THE PROPOSED ACTION AND ALTERNATIVES

M-1.C.1 GENERAL DESCRIPTION

The proposed Magic Circle project would involve mining 70,000 tons per day of oil shale, processing it to remove the crude oil, processing the oil to form the crude shale oil product, transporting the oil by pipeline, and disposing the spent shale after processing. The proposed project would consist of the following major components:

1. Underground room-and-pillar mine that would be 880 feet deep.
2. Processing plant with Improved NTU/T3 retorts (located on the 200-acre plant site).
3. 40-mile product pipeline (to Plateau Refinery in Roosevelt, Utah, and with a tie-in to the existing Chevron pipeline including a 30-acre pump station) and a 25-mile product pipeline (tie-in to existing line at Bonanza, Utah, for distribution to refining facilities in Fruita, Colorado).
4. Spent shale disposal system, including a 1,880-acre disposal area.
4. Wastewater treatment system.
5. Solid and hazardous waste disposal systems.
6. Ancillary facilities including:
   access road (0.75 mile)
   water pipeline (12.5 miles)
   power transmission line (5 miles)
   communication facilities

The overall project schedule as submitted by Magic Circle is shown in Figure M-1-1. This schedule is subject to change based upon completion of the EIS and decisions on the requested rights-of-way grants. The estimated time required from start of construction to full-scale production is five years. A 30-year project life is planned.

In addition to the proposed action, the following alternatives were analyzed for the Magic Circle project: (1) project alternatives - no action, and (2) component alternatives - Paraho Process processing alternative, on-site wells and White River and Green River water source alternatives, and a power transmission line location alternative.

M-1.C.2 LOCATION OF COMPONENTS

The proposed plant site, including the mine, would be located in Section 19 of Township 10 South, Range 25 East in Uintah County, Utah. Map M-1-1 shows the various plant and mine components located on the lease area. Map R-A-1 (located in Appendix R-A) shows the location of all rights-of-way and their relationship to the other proposed synfuel projects in the Uintah Basin.

M-1.C.3 LAND STATUS AND OWNERSHIP

The proposed project area, including components on the lease area and the off-site rights-of-way, would involve federal, state, and private lands, and lands of the Uintah and Ouray Indian Reservation. Table M-1-1 shows the miles and acres of each type of land required for components of the proposed project and alternatives. Map R-A-3 in Appendix R-A shows the land ownership graphically.

M-1.D **PROPOSED ACTION**

M-1.D.1 CONSTRUCTION, OPERATION, MAINTENANCE, AND ABANDONMENT

Construction

Construction of the proposed project is scheduled to begin in 1983 and would continue through 1989. The construction work force would peak in 1987 at 820 workers. The total area disturbed during construction would be 2,491 acres.

As shown on Figure M-1-1, construction activities would begin progressively. Construction of utilities such as the transmission line and water pipeline would begin first, followed by the mine and material handling systems, and finally processing facilities.

During construction, about 84,400 tons of major equipment, such as retorts and large mining equipment, would be transported over public highways. Assuming that these items arrive in Vernal and are then transported to the site in 1,688 50-ton loads, it is estimated that 75,960 vehicle-miles would be required to move the major equipment onto the site. Because of the modular

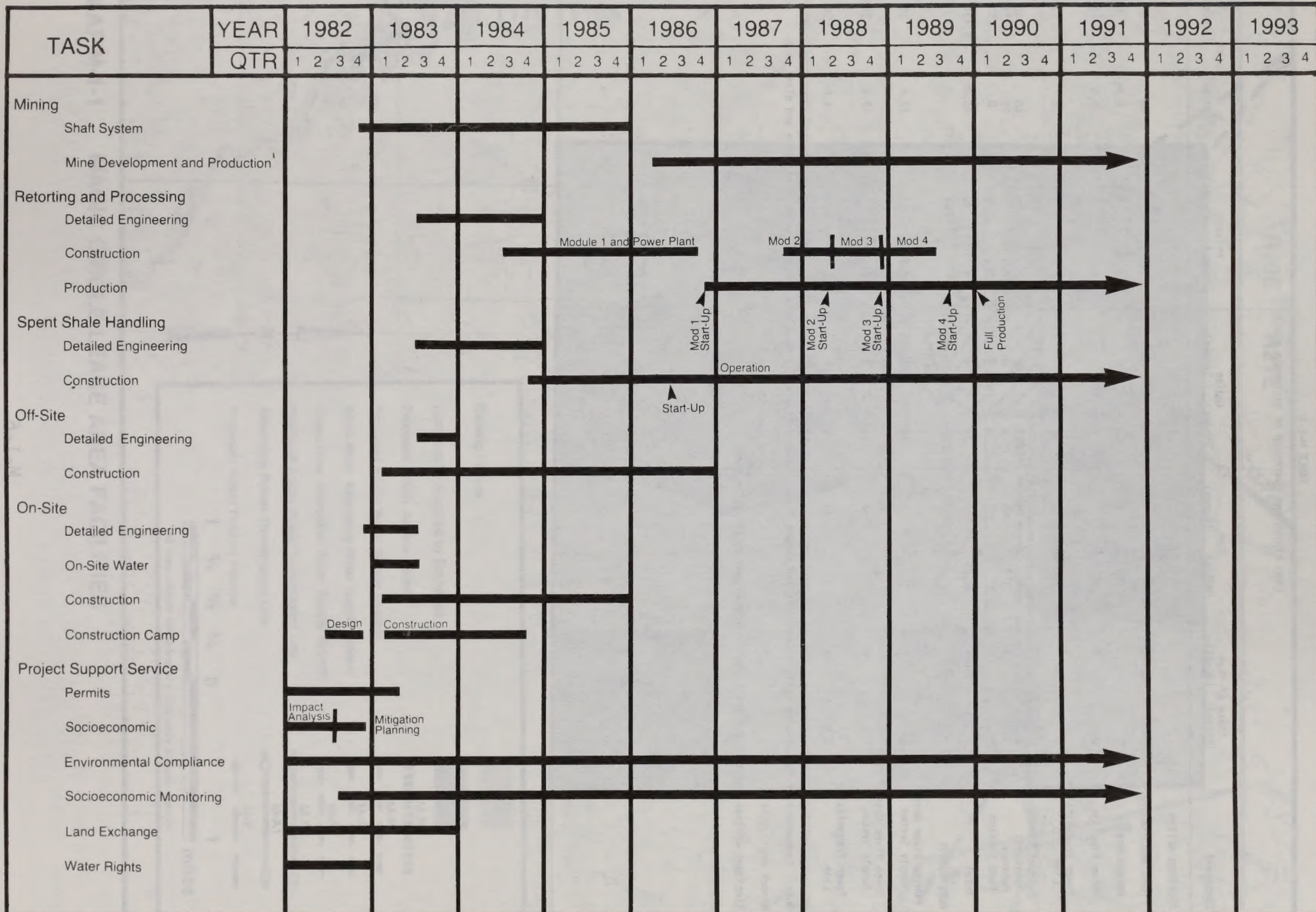


FIGURE M-1-1. MAGIC CIRCLE COTTONWOOD WASH PROJECT SCHEDULE

TABLE M-1-1

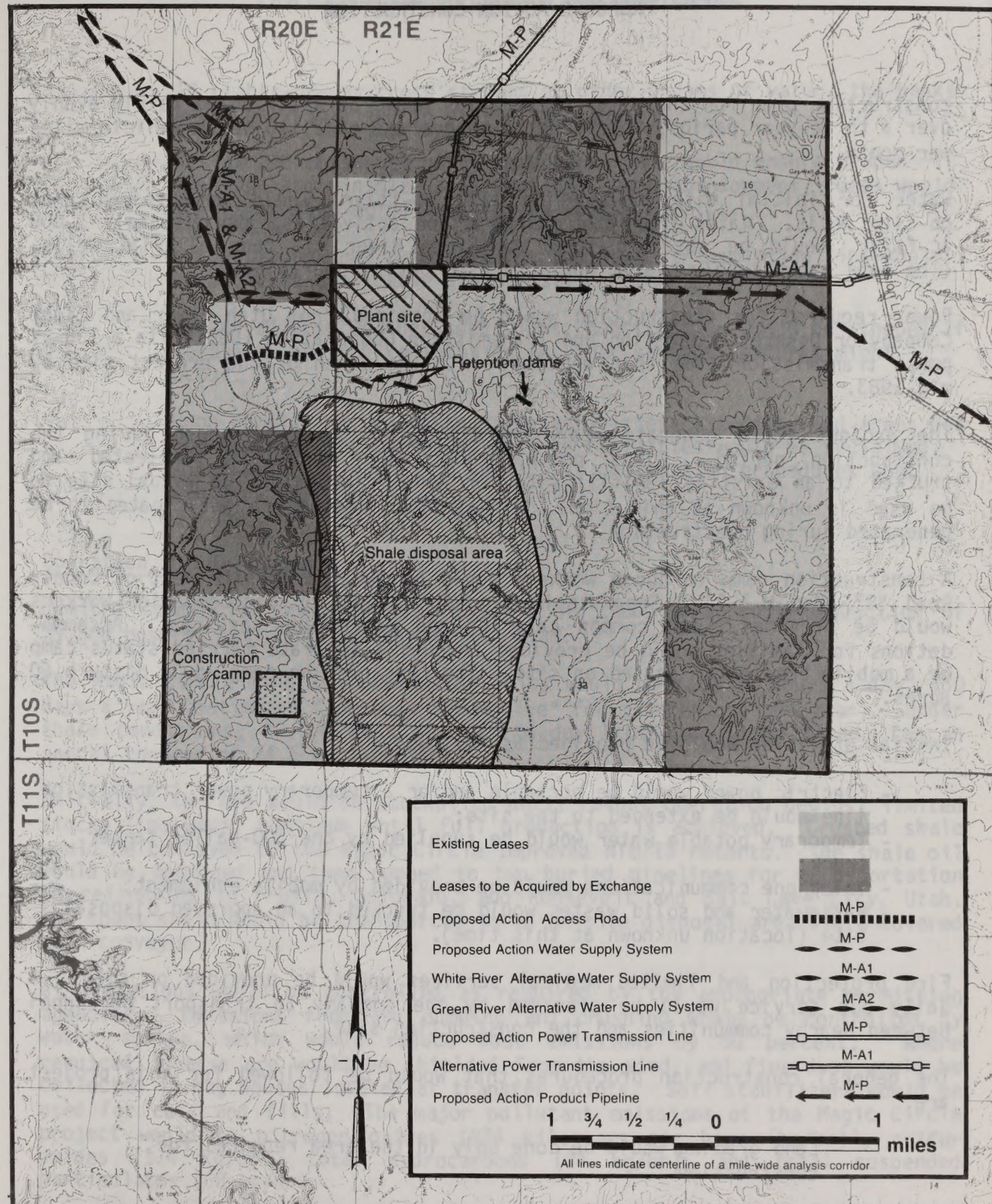
LAND STATUS AND OWNERSHIP OF DISTURBED ACRES

Component	State of Utah (Miles)	State of Utah (Acres)	BLM (Miles)	BLM (Acres)	Indian (Miles)	Indian (Acres)	Private (Miles)	Private (Acres)	Total (Miles)	Total (Acres)
PROPOSED ACTION										
Mine and Plant[a]	NA	2,135	NA	0	NA	0	NA	0	NA	2,135
Access Road	0	0	0.75	6	0	0	0	0	0.75	6
Water Pipeline	0	0	2	2	10	7	0.5	1	12.5	10
Power Transmission Line	0	0	5	33	0	0	0	0	5	33
Product Line										
Roosevelt	0	0	3	10	29	102	8	28	40	140
Bonanza	3	9	21.5	66	0	0	0.5	2	25	77
Pump Station	NA	0	NA	0	NA	0	NA	30	0	30
Total	3	2,144	32.25	117	39	109	9	61	83.25	2,431
ALTERNATIVE										
White River Water Supply System	0	0	2	2	10	7	0.5	1	12.5	10
Green River Water Supply System	0	0	2	2	10	7	0.5	1	12.5	10
Power Transmission Line	2.5	16	3	20	0	0	0	0	5.5	36

Note: Components of the On-site Wells Alternative and Paraho Process Alternative would be located within the proposed mine and plant site.

NA=not applicable.

[a]Includes acreage required for spent shale disposal and construction camp.



MAP M-1-1 MAGIC CIRCLE LEASE AREA FACILITIES

construction plan for the site, these trips would be distributed fairly evenly over a three-year period, resulting in an average of 2,110 heavy-vehicle miles per month.

Water for initial site preparation (120 ac-ft/yr) would be obtained from on-site wells. Water for later construction activities, approximately 1,000 ac-ft/yr, would be obtained from the Green River via four alluvial wells. (The same water supply system would be used during operation.)

Power required for construction would be obtained from Utah Power and Light Company or Deseret Generation and Transmission Cooperative (DG&T) via a 138-kV power transmission line that would be in place north of the project site by mid-1983.

The project would generate approximately 30,000 tons of trash during the construction period. This non-hazardous waste would be collected and trucked to an existing landfill site for final disposal. The actual site to be used is unknown at this time. No hazardous wastes are anticipated to be generated during construction.

A construction camp to house workers would be located on-site west of County Road "B" (Map M-1-1). Separate housing for single or unaccompanied workers would be provided, with common catering and recreation services. Accommodations for families would be provided through a separate married-status camp or a mobile home park located on site. The construction camp would disturb 60 acres.

Initial utilities would be provided as follows:

- Electric power would be portable and/or a temporary power transmission line would be extended to the site;
- Temporary potable water would be supplied by one 500-gallon tanker truck;
- Telephone communications would be provided by mobile equipment;
- Wastewater and solid wastes would be trucked to an approved disposal site (location unknown at this time).

Fire protection and limited medical services would be provided on site. A daily bus service would be provided by the company to transport personnel between nearby communities and the construction site.

The general construction procedures that would be followed for this project are:

- Land grading would be done only in the area required for construction.

- Existing ground cover would be conserved.

- Trees and shrubs along rights-of-way that are not cleared would be protected from damage during construction.

- If rights-of-way cross streams or other bodies of water, the banks would be stabilized to prevent erosion.

- Design and construction of temporary roads would ensure proper drainage and minimize soil erosion. Upon abandonment, roads would be restored as stipulated in applicable permits.

- Product pipeline, pump station, and power transmission line would be built to applicable standards.

- During adverse weather conditions, construction would be stopped if damage to on-site reclamation or other surface features might occur.

- Upon completion of construction activities, all disturbed areas not required for the permanent surface facilities would be reclaimed. (See Apprendix R-J for a summary of reclamation procedures that would be used.)

Operation and Maintenance

Limited commercial operation would begin in 1986, with full production of 31,500 bpsd of shale oil anticipated by 1988.

The Magic Circle mine and processing units would operate 24 hours a day, 350 days a year (estimated 4 percent "down time" for maintenance per year). Under these conditions, 70,000 tons per stream day (tpsd) would be mined, for an annual tonnage of 24.5 million tons.

Initially, the ore would be stockpiled until retort operation begins; limited stockpiling would continue until full production is achieved. Crushed shale would be conveyed to the Magic Circle Improved NTU/T3 retorts. The shale oil would be upgraded and then pumped to two buried pipelines for transportation to refineries in Fruita, Colorado, and Roosevelt and Salt Lake City, Utah. The spent shale would be transported to an on-site disposal area via a covered belt conveyor.

Air emissions would be controlled as required by the appropriate permitting agencies. Emissions from ore dumping and crushing would be controlled by water sprays, which would reduce dust emissions by 50 percent. Where required, coarse ore would be shielded from the wind, and fine dust would be collected in bag houses located at transfer points. Soil stabilizers would be used for cuts and fills. The major pollutant emissions of the Magic Circle project would be nitrogen oxides (974 kilograms per hour (kg/hr)), sulfur oxides (174 kg/hr), total hydrocarbons (24 kg/hr), and total suspended particulates (68 kg/hr).

The project would include measures to prevent and control oil spills. Any area within the plant that could be contaminated by oil and is subject to washing down by hose or by rain would be tied in to the oily water sewer

system. All oily water would be directed by this sewer system to an oil/ water separator for reprocessing.

Proper specifications and adequate field inspection throughout the construction period would assure integrity of the pipeline system. Throughout the life of the pipelines, corrosion would be monitored in order that the maintenance operations can be scheduled in a timely manner. Flow metering instruments would be installed at each terminal with repeaters providing readout on the main control panel. Any appreciable difference between the flow rate at the beginning and end of the pipeline would sound an alarm in the main control house. Crews would then be sent out to locate the leak. Ample crude oil storage is provided to cover normal shutdown of the line for repair.

Other general operating procedures that would be followed to reduce the impacts of the Magic Circle project include:

- A combination of control measures to reduce dust emissions would be used. Spent shale placed in the fill area would be sprayed with chemical stabilizers. Revegetation would begin promptly once any section of the spent shale pile reaches design elevation.

- Electric power as opposed to diesel power would be used wherever possible in the handling of raw and spent shale, thereby minimizing gaseous emissions.

- Roads would be paved where possible, and speed controls would be in effect to reduce dust emissions from surface travel.

- Maintenance of valves, flanges, and pump seals would be included in a routine housekeeping program.

- To minimize water consumption, all gas cooling and steam condensing activities would use fin-fan units (air coolers). Water would be recycled or used in another part of the process wherever possible. For example, underground water from the mine would be used in the plant as raw water makeup, and surface drainage water would be collected for use in the plant.

- Dust from mining activities would be minimized by wet suppression techniques, proper selection of explosives, baffled settling, and ample ventilation.

Abandonment

After the leased resources are exhausted and the mine is abandoned, economically salvageable equipment would be removed from the mine. The mine shafts would be sealed to remove the hazards to humanity and wildlife.

Safe access to permanent impoundments would be provided for wildlife, livestock, and humanity. If some impounded waters are considered detrimental

to humans or animals, access would be prevented by construction of permanent barriers.

Surface structures would be taken down to grade. The land would not be returned to its original contours, but disturbed areas would be rehabilitated. Revegetation of the spent shale disposal area and maintenance of revegetated areas would be continued for an adequate time, as established during permitting activities. Refer to Appendix R-J for summary of reclamation procedures to be used.

M-1.D.2 PROJECT COMPONENTS

The General Mining, Processing, and Upgrading Techniques section included in the Site-Specific Analyses Introduction of this EIS describes, in a general way, the mining and processing facilities that would be used in the Magic Circle project. The descriptions of the major components of the proposed project which follow include specific details about these facilities as well as the materials handling, spent shale disposal, wastewater treatment, and solid and hazardous waste disposal systems; the product pipelines; and ancillary facilities.

Mine System

Oil shale would be extracted from the mine by the room-and-pillar mining method with conventional drilling, blasting, and mucking techniques. Loaders and conveyors would be used for ore transport. Each subsection would be 1,250 feet wide by 2,944 feet long. The barrier, chain, and ventilation pillars would provide stable ground conditions and would isolate each panel for ventilation purposes.

Materials Handling System

Run-of-mine material would be crushed underground for efficient handling. Feeder breakers would be used to load the conveyors and reduce run-of-mine oil shale to the size needed for retort feed. Fines would be monitored to determine the effectiveness of the system, and adjustments would be made as required.

The raw shale would be hoisted to the surface and transported by conveyors from the headframe ore bins to a sampling plant, to a stockpile, to a screening plant, to a fine shale handling facility, and finally to retort feed. The only crusher in the above-ground system would be a lump breaker which feeds to the screening plant.

Two 350,000-ton raw shale stockpiles would be required. The space required for these stockpiles and for the associated reclamation system would cover an area approximately 450 feet wide by 2,500 feet long. This area would be stripped of topsoil and contoured with a very slight slope so that runoff

could be contained. Portions of this area would subsequently be used for spent shale disposal.

Retorting and Upgrading System

Magic Circle proposes to use the Improved NTU/T3 retorting process, which is discussed in more detail in the Site-Specific Analysis Introduction of this EIS. There would be 112 retorts, divided into 4 modules of 28 each.

The two principal products of the retort would be a gas stream and a liquid stream. The retort gases would be cooled and compressed for use in the power generation facility. A small amount of the retort off-gas could be used for retort ignition.

A fluid bed combuster which would use the raw shale fines and the retort off-gas, would reduce the sulfur in the stack to an acceptable level and produce high-pressure steam for generating electricity. The oil from the retort would pass through a successive number of steps to remove the water and then would be pumped to product storage and shipped to market via a pipeline.

Water produced in the retort, in addition to the steam, would be used to recover heat in the spent shale and to control the oxygen concentration in the air required for retorting. Excess water would be treated and transported to the spent shale disposal area.

Spent Shale Disposal

Spent shale would leave the retorts at a maximum temperature of 250° F. The potential for spontaneous combustion of the spent shale would be non-existent because of the retorting process's complete carbon utilization and low discharge temperature.

About 49,000 tons per stream day of spent shale would require disposal. It would be carried to the disposal area from the processing plant on a covered belt conveyor. Because of the continuous flow of spent shale from the processing plant, the conveyor and associated equipment are scheduled to operate 24 hours per day, 7 days per week.

Spent shale would be isolated from runoff and ground water by impermeable boundaries made from 18-inch layers of oven-dry shale fines surrounding the disposal pile. Because spent shale contains some soluble inorganic salts, this impermeable barrier would remove the potential for ground water contamination from surface runoff and percolation through the pile. An 18-inch layer of topsoil and other suitable plant growth material would be added prior to revegetation. (Refer to Commercial Shale Oil Production Project Description (Magic Circle 1982) for a complete explanation of disposal pile design and reclamation procedures.)

The disposal area would be located entirely on Magic Circle property within the isolated small drainage basin south of the plant site which joins

Cottonwood Wash (Map M-1-1). After approximately 30 years, the pile would cover approximately 1,880 acres and be 260 feet high. It would be no higher than the highest point of the existing terrain. Total drainage area would encompass approximately 3 square miles. This location would localize the disturbance within an isolated area and simplify runoff containment procedures. Drainage upstream (south) of the spent shale disposal area would be diverted into Cottonwood Wash.

Wastewater Treatment System

Wastewater (approximately 540 ac-ft/yr) would be collected from the mine and processing plant, treated by a conventional portable treatment plant, combined with mine drainage water, and used on the spent shale pile. Any wastewater contaminated with oil would be sent to the slop oil tank for reprocessing.

Product Pipelines

Ten days' production of shale oil would be stored on site to feed the product lines. Two product pipelines, each capable of carrying the full production, would be constructed. They would be capable of pumping shale oil to any combination of three refineries--the Gary Refinery in Fruita, Colorado, the Plateau Refinery in Roosevelt, Utah, and Salt Lake City area refineries.

One 10-inch diameter, 25-mile long pipeline would follow existing roads to Bonanza, where it would connect into an existing pipeline that carries conventional crude oil to the Gary Refinery (Map R-A-1, located in Appendix R-A). This pipeline would transport at least 30,000 bpsd. It would not require batching of the crude oil, because it would be a single product line.

The other 10-inch diameter pipeline would extend 40 miles along existing roadways to the Plateau Refinery at Roosevelt. At a point 4 to 5 miles north of Ouray, Utah, this pipeline would branch to a batching station that would connect with the existing Chevron pipeline, which transports crude oil to the Salt Lake City area refineries (Map R-A-1, located in Appendix R-A). A pump station with an approximate 500,000- to 750,000-barrel storage capacity would be required. This station would occupy about 30 acres of land. The floating roof tanks used at the station would minimize any vapor loss to the atmosphere. No emissions are expected at the pump station.

The pipeline to Roosevelt would transport at least 30,000 bpsd. It would not require batching of the crude oil, because it would be a single product line. However, because of the nature of the crude shale oil, it is anticipated that a batching station would be required at the point where the main pipeline would branch to connect with the Chevron line.

Both Magic Circle product pipelines would be buried below the normal frost line. Cathodic protection would be utilized to eliminate corrosion. These pipelines would be common carriers and thereby would be operated under Public Utility Commission regulations.

Where stream crossing is required, the stream would be diverted for the time required to cross the stream bed, then the original stream bed would be restored. Roadway crossings would require temporary detours during that part of the construction.

Assuming a rupture would occur at the maximum spill point (i.e., where the block valves would be the maximum distance apart or where the driving time to a rupture would be longest), a pipeline could lose a maximum of 1,800 barrels of shale oil in the event of spill or rupture on land. The product pipeline would cross the White River twice and the Green River once. Assuming a worst-case spill at each location (5 minutes for confirmation of rupture and pump shutdown; complete rupture between manually operated block valves located on each side of a river), 1,100 to 1,200 barrels of oil could be spilled directly into a river.

Ancillary Facilities

Access Road

A 0.75-mile long, 33-foot wide road would be constructed from the existing County Road "B" in Section 13, Township 10 South, Range 20 East, to the plant site. A total of 6 acres would be disturbed for 1 year.

Water Supply System

Water for site preparation and initial mine shaft sinking would be supplied from on-site wells drilled 3,000 feet into the Douglas Creek aquifer. A 400 gallons/minute capacity pump would pump the ground water directly into a 150,000-barrel water storage tank. The 540 ac-ft/yr of water needed for operation and the additional, but temporary, (approximately 1,000 ac-ft/yr) water needed for construction would be obtained from the Green River in four 200-foot alluvial wells. The water would be transported to the plant site via an 8-inch diameter, 12.5-mile long buried pipeline that would follow the existing County Road "B" and the proposed plant site road (Map R-A-1, located in Appendix R-A).

A right-of-way adjacent to County Road "B" would be needed for the water pipeline. The road would provide access. About 10 acres would be disturbed by construction of this pipeline.

Power Supply System

All electrical power for steady-state operation would be supplied by an on-site generating plant. Power from a 138-kV overhead line running from the proposed Tosco plant site south to the Magic Circle plant site would be used for construction, for initial start-up, and for intermittant needs during operation. All power would be interfaced at the main 138-kV substation, and switch gear would distribute power to the principal use points for further distribution.

When full production is underway, the Magic Circle project would generate (by burning shale fines) an excess of at least 44 megawatts of electric power that could be exported to the utility grid.

Solid Waste Disposal System

Miscellaneous plant trash, garbage, and other nonhazardous waste would be trucked to an existing landfill. Water-sprayed shale dust from bag houses would be used as a portion of the fuel for the atmospheric fluid-bed boilers.

Hazardous Waste Disposal System

No hazardous waste would be generated during operation of the Magic Circle project.

Communication System

A digital microwave system would be installed for linkage with the Mountain Bell system in Utah. A base station would be installed on site and in Vernal; a relay system would be installed in a line of sight between the base stations. Certain lines would be dedicated for emergency uses.

M-1.E **ALTERNATIVES**

M-1.E.1 SMALL-SCALE PARAHO PROCESS ALTERNATIVE

This alternative would be identical to the proposed action except that small-scale Paraho retorts would be used instead of Magic Circle's Improved NTU/T3 retorts. This alternative would require 2,842 ac-ft of water per year.

M-1.E.2 ON-SITE WELLS ALTERNATIVE WATER SUPPLY SYSTEM

This alternative would supply water from the Douglas Creek aquifer in the Green River Formation. As many wells as would be needed to yield a maximum 1,600 ac-ft/yr of water (approximate amount of water needed for construction and operation) would be drilled within the plant site. Because the wells would be on site, no additional acres would be disturbed, and there would be no need for an off-site water pipeline.

M-1.E.3 WHITE RIVER ALTERNATIVE WATER SUPPLY SYSTEM

Under this alternative, water for the plant site would be purchased from the White River Dam project. The point of diversion would be near the confluence of the White River with the Green River, so the pipeline location and size would be identical to those required by the proposed action (Section M-1.D.2,

Water Supply System). See Map R-A-2, located in Appendix R-A, for the location of this alternative.

M-1.E.4 GREEN RIVER ALTERNATIVE WATER SUPPLY SYSTEM

Under this alternative, water would be obtained from the Green River. The point of diversion would be located in Section 13, Township 5 South, Range 19 East. Total pipeline length would be 13 miles, of which the last three would be different than those of the proposed action; otherwise, the location and size of the pipeline would be identical to those required by the proposed action (Section M-1.D.2, Water Supply System). See Map R-A-2, located in Appendix R-A, for the location of this alternative.

M-1.E.5 ALTERNATIVE POWER TRANSMISSION LINE

This alternative transmission line route would run from the main plant site east for 5.5 miles and tie into the main line proposed by Tosco (see Section T-1.D.2), at their conveyor transformer site (Map R-A-2, located in Appendix R-A). Construction of the line would disturb 36 acres, which would be reclaimed after construction.

M-1.E.6 NO-ACTION ALTERNATIVE

The No-Action Alternative would involve the denial of the proposed rights-of-way for the access road, water pipeline, product lines, and power transmission line (refer to the No-Action Alternative section of the Site-Specific Analyses Introduction of this EIS for additional explanation of the purpose of this alternative). Without these rights-of-way, Magic Circle would not be able to develop the proposed Cottonwood Wash Project.

M-1.E.7 ALTERNATIVES CONSIDERED BUT ELIMINATED FROM DETAILED ANALYSIS

No alternatives that have been proposed were eliminated from detailed analysis.

M-1.F **DATA SUMMARY**

Various aspects of the Magic Circle project and alternatives (where applicable) are summarized in Table M-1-2, Magnitude and Duration of Land Disturbance; Table M-1-3, Personnel Requirements; Table M-1-4, Resources Consumed and Produced During Operation; and Table M-1-5, Total Controlled Air Emissions.

TABLE M-1-2

MAGNITUDE AND DURATION OF LAND DISTURBANCE

Component	Length (Miles)	Construction Width/Size	Operation Width/Size	Maximum Disturbed Acres/Duration[f]	Removed Acres/Duration	Reclaimed Acres
PROPOSED ACTION						
Mine and Plant	NA	NA	NA	200/30 years	200/30 years	0
Spent Shale Disposal Area	NA	NA	NA	1,880/30 years	1,880/30 years	1,800
Retention Ponds	NA	NA	NA	55/40 years	55/40 years	0
Access Road	0.75	67 ft[a]	47 ft	6/ 1 year	4/30 years	2
Product Pipeline						
Roosevelt-Section 1[b]	20	20 ft[c]	20 ft	47/ 1 year	0	47
Roosevelt-Section 2[b]	20	40 ft	40 ft	93/ 1 year	0	93
Bonanza	25	25 ft	25 ft	77/ 1 year	0	77
Pump Station	NA	1,143 ft x 1,143 ft	1,143 ft x 1,143 ft	30/30 years	30/30 years	0
Water Pipeline	12.5	5 ft[c]	5 ft	10/ 1 year	0	10
Power Transmission Line	5	20 ft road 50 ft radius/ pole	20 ft	33[e]/ 1 year	0	33
Communication System	No Disturbed Acres (Microwave System)					
Construction Camp	NA	NA	NA	60/ 5 years	60/ 5 years	60
TOTAL				2,491	2,229	2,202
ALTERNATIVES						
White River Water Supply System	12.5	5 ft	5 ft	10/ 1 year	0	10
Transmission Line	5.5	20 ft road 50 ft radius/ pole	20 ft	36/ 1 year	0	36
Green River Water Supply System	12.5	5 ft	5 ft	10/1 year	0	10/1 year

Note: All facilities required for the Paraho Process Alternative and On-site Wells Alternative would be located within the plant site.

NA=not applicable

[a]Assumed 33-foot road, 3 shoulders, 4-foot ditches, and 10-foot clearing limit.

[b]Section 1 = plant site to Chevron Pipeline tie in; Section 2 = Chevron Pipeline tie in to Roosevelt.

[c]Assumed use of county road in addition to 20-foot construction right-of-way.

[d]Assumed use of 25-foot existing road in addition to 5-foot construction right-of-way.

[e]Assumed 2.3 acres/mile for road and 4.2 acres/mile for poles.

[f]Maximum disturbed duration equals maximum duration and/or active land use.

TABLE M-1-3

PERSONNEL REQUIREMENTS

Year	Construction	Operation	Total
1982	380	60	440
1983	775	175	950
1984	550	450	1,000
1985	520	835	1,355
1986	820	1,430	2,250
1987	780	1,755	2,535
1988-2018	0	1,890	1,890

Note: Work force estimates are based on the estimated number of workers at each year's end. Numbers have been rounded to the nearest 5.

TABLE M-1-4

RESOURCES CONSUMED AND PRODUCED DURING OPERATION

Resources Consumed	Amount	Resources Produced	Amount
Oil Shale	70,000 tons/day	Shale Oil	31,500 barrels/day
Water	540 acre-feet/year	Power	44-200 megawatts/day[a]

[a]Power exported would depend upon efficiency of power operation system employed.

TABLE M-1-5

TOTAL CONTROLLED AIR EMISSIONS

Pollutant	Emissions Rate[a] (kilograms per hour)
Total Suspended Particulates	68
Sulfur Oxides	174
Nitrogen Oxides	974
Carbon Monoxide	56
Hydrocarbons	24

[a]During peak operation of the facility.

CHAPTER M-2
MAGIC CIRCLE COTTONWOOD WASH PROJECT
COMPARATIVE ANALYSIS OF PROPOSED ACTION AND ALTERNATIVE

The Magic Circle Cottonwood Wash Project proposed action (a complete system) and alternatives (component and process) are compared in this chapter. Various component and process alternatives and components of the proposed action can be assembled into a range of complete system alternatives. Table M-2-1 provides a comparative analysis of significant quantifiable impacts of the proposed action and the alternatives that would result if the Magic Circle project is implemented. Unavoidable adverse impacts listed in the table are negative environmental impacts that would remain despite mitigation efforts. Adverse impacts that are of low significance or of very short duration are not included.

The No-Action Alternative is not included in the comparison. With this alternative, the project would not be constructed and the impacts associated with the proposal or the other alternatives would not occur.

TABLE M-2-1

SUMMARY COMPARISON OF IMPACTS BETWEEN PROPOSED ACTION AND WATER SUPPLY SYSTEM ALTERNATIVES

Environmental Element	Proposed Action	White River Alternative Water Supply System	Green River Alternative Water Supply System	On Site Wells Alternative Water Supply System
Air Quality	147 kg/hr of SO_2 107 kg/hr of TSP 823 kg/hr of NO_x 4 kg/hr of THC 53 kg/hr of CO (PSD and NAAQS incremental limitations would be met for all except TSP)	**	**	**
Water Resources	540 ac-ft/yr less flow in the Green River (0.001% of annual flow)	540 ac-ft/yr less flow at the mouth of the White River of (0.1% of average annual flow) and downstream in the Green River	**	Disturbances and facilities and restricted to lease area. No reduction in flow of White River or Green River. Quality of on-site water questionable.
Vegetation, Soils and Reclamation	2,491 acres disturbed of which 289 ac not reclaimed	**	1 ac more disturbed and not reclaimed	13 ac more disturbed
Wildlife	2,169 acres of habitat would be disturbed for the life of the project	**	1 ac more disturbed habitat and not reclaimed	13 ac more disturbed habitat
Agriculture	137 AUMs lost for grazing on rangeland	**	1 AUM less grazing	2 AUMs less grazing
Recreation	1 mi of White/Green River Wild and Scenic consideration affected	**	**	White River or Green River Wild and Scenic River consideration not affected
Land Use Plans	12 mi of water or product pipelines would be outside planned BLM corridor. 39 miles of water or product pipelines would be within Uintah and Ouray Indian Reservation	1.5 mi less water pipeline within Uintah and Ouray Indian Reservation	1 mi more of water pipeline outside of BLM planned corridor	2 1/2 mi of water pipeline would not be outside of BLM proposed corridor. 10 miles of water pipeline would not be within the Uintah and Ouray Indian Reservation.

NOTE: Figures are the projected change to baseline due to development of the Magic Circle project.

When "more" or "less" appears in the description of alternative impacts, impacts are being compared to comparable components or processes of the proposed action.

ac = acres; ac-ft/yr = acre feet per year; AUMs = animal unit months; CO = carbon monoxide; kg/hr = kilograms per hour; mi = miles; NAAQS = National Ambient Quality Standards; NO_x = nitrogen oxides; PSD = Prevention of Significant Deterioration; SO_2 = sulfur dioxide; TSP = total suspended particulates; THC = Total Hydrocarbons.

*Only those elements that have impacts that vary significantly from the proposed action are shown.

**Where no entry is made for an alternative, the impact would not vary significantly from that of the proposed action.

TABLE M-2-2

SUMMARY COMPARISON OF IMPACTS BETWEEN PROPOSED ACTION, SMALL-SCALE PARAHO PROCESS AND POWER TRANSMISSION LINE ALTERNATIVES

Environmental Element	Proposed Action	Small-Scale Paraho Process Alternative	Alternative Power Transmission Line
Air Quality	147 kg/hr of SO_2 107 kg/hr of TSP 823 kg/hr of NO_x 4 kg/hr of THC 53 kg/hr of CO (PSD and NAAQS incremental limitations would be met for all except TSP)	5 kg/hr less of SO_2 31 kg/hr less of TSP 67 kg/hr less of NO_x 20 kg/hr more of THC 32 kg/hr less of CO (PSD increment consumption and NAAQS impacts would be same as for proposed action)	**
Water Resources	540 ac-ft/yr less flow in the Green River (0.001% of annual flow)	**	**
Vegetation, Soils and Reclamation	2,491 acres disturbed of which 289 ac not reclaimed	**	10 ac less disturbed
Wildlife	2,169 acres of habitat would be disturbed for the life of the project	**	10 ac less disturbed
Agriculture	137 AUMs lost for grazing on rangeland	**	**
Recreation	1 mi of White/Green River Wild and Scenic consideration affected	**	**
Land Use Plans	12 mi of water or product pipelines would be outside planned BLM corridor. 39 miles of water or product pipelines would be within Uintah and Ouray Indian Reservation	**	**

NOTE: Figures are the projected change to baseline due to development of the Magic Circle project.

When "more" or "less" appears in the description of alternative impacts, impacts are being compared to comparable components or processes of the proposed action.

ac = acres; ac-ft/yr = acre feet per year; AUMs = animal unit months; CO = carbon monoxide; kg/hr = kilograms per hour; mi = miles; NAAQS = National Ambient Quality Standards; NO_x = nitrogen oxides; PSD = Prevention of Significant Deterioration; SO_2 = sulfur = total suspended particulates; VRM = Visual Resources Management; THC = Total Hydrocarbons.

*Only those elements that have impacts that vary significantly from the proposed action are shown.

**Where no entry is made for an alternative, the impact would not vary significantly from that of the proposed action.

The affected environment for the Magic Circle Cottonwood Wash Project (Magic Circle) is that part of the existing environment that would be affected by the proposed action (including all project components identifed in Chapter M-1) or alternatives. The effects of the project components and the construction and operation work forces on the environment were analyzed for the same resources as identified for the regional analysis (Chapter R-3, Introduction). This chapter provides information only about the environment that would be significantly affected by the Magic Circle project as determined by the impact analysis presented in Chapter M-4. Analysis indicated that several resources would not be significantly affected by the Magic Circle project. Therefore, descriptions of the following resources were not included:

- Paleontology
- Wilderness - no Wilderness Areas or any areas under formal wilderness review, study, or appeal would be directly or indirectly affected by the proposed action or alternatives.

M-3.A **PROPOSED ACTION**

M-3.A.1 SOCIOECONOMICS

The Magic Circle project would primarily affect Uintah and Duchesne counties in Utah. Because of the close proximity of the project to the Uintah and Ouray Indian Reservation, the reservation also would be affected. Very few, if any, areas in Colorado would be affected. Section R-3.A.1, Socioeconomics, describes the present and future baseline environment of the counties, communities, and the Colorado area in the area of influence as well as the Uintah and Ouray Indian Reservation.

M-3.A.2 AIR QUALITY

The Magic Circle plant site would be located in terrain which gently slopes to the north and west toward the White and Green rivers, respectively. Drainage flows would carry emissions to the north and west. Estimated baseline pollutant concentrations and the National Ambient Air Quality Standards (NAAQS) are shown in Table M-4-2 (Section M-4.A.2), which indicates that no NAAQS violations occur, except possibly for total suspended particulates. The high particulates levels predicted result primarily from traffic on dirt roads and soil particles suspended during windy conditions. Visibility measurements taken at Dinosaur National Monument are presented in Section R-3.A.2, Air Quality.

M-3.A.3 WATER RESOURCES

The surface water, floodplains, and ground water that would be affected by the Magic Circle project are described in Section R-3.A.3, Water Resources.

M-3.A.4 VEGETATION, SOILS, AND RECLAMATION

Vegetation cover on the proposed Magic Circle project area is of the mixed-desert shrub type. See Section R-3.A.4, Vegetation and Soils, for description of the plant communities that would be affected and their species compositions.

The hookless cactus (Sclerocactus glaucus), a federally listed threatened species, is known to occur on sandy to gravel benches along the Green River and the Duchesne River through the Uintah and Ouray Indian Reservation. One hookless cactus plant has been located on site.

Soils and Reclamation

Soils within the proposed project area are forming in a setting with an average annual precipitation of 5 to 10 inches and an average frost-free season of 110 to 125 days. The predominant soils within the lease area are shallow to moderately deep, moderately to strongly alkaline upland soils with thin surface layers, low inherent fertility, and containing varying amounts of rock fragments. They are on sloping to moderately steep convex ridges and sideslopes. Deeper soils are in the concave drainageways. Rock outcrop areas are common on the steeper sloping ridges. Soil used for irrigated cropland, which would be found along the product pipeline to Roosevelt (between Ouray and Roosevelt), are predominantly deep, well-drained loamy soils occupying nearly level to gently sloping areas that are more favorable for reclamation.

Vegetative cover in the native range area is difficult to reestablish due to low precipitation, variable soil depths and unfavorable soil properties, and slope.

Detailed soil surveys have been made of the project area for use in determining applicable reclamation procedures (SCS and BLM 1981).

M-3.A.5 WILDLIFE

Habitat Types

The primary wildlife habitat type occurring on the project area is the desert-shrub type (see Section R-3.A.4, Vegetation, and Soils , for description of this type). Some riparian habitat would be encountered by the product pipelines on the Green River and the White River; some riparian habitat would be encountered adjacent to the Green River by the water pipeline.

Terrestrial Wildlife

No critical areas have been identified for mule deer in the project area. However, the entire lease area is classified as year-long, high priority pronghorn antelope range (UDWR 1981). Both the product pipeline and the water pipeline would cross high priority pronghorn antelope range.

Approximately 650 acres of substantial value, year-long sage grouse range would be located in the extreme southern portions of the main plant site (UDWR 1981). Raptors common to the project area include red-tailed hawks, golden eagles, prairie falcons, marsh hawks, and American kestrels. The shallow, sage-covered draws in this area furnish nesting habitat for marsh hawks, while the riparian zone along the White River furnishes many tree nesting sites for other species of raptors. The entire area, however, is hunting habitat for all species of raptorial birds.

The species of nongame mammals, nongame birds, and reptiles and amphibians that could be found on the project area are similar to those found throughout the Uintah Basin. Refer to Section R-3.A.5, Wildlife, for a discussion of these species.

Threatened or Endangered Species

The U.S. Fish and Wildlife Service identified several federally listed animal species which could occur within the project area (Table R-3-11 and Appendix R-K). Three endangered fishes can be found in the White River near the project site--the Colorado squawfish (Ptychocheilus lucius), the humpback chub (Gila cypha), and the bonytail chub (Gila elegans).

M-3.A.6 AGRICULTURE

Cropland

There is no cropland located within the lease area or within any of the facility corridors of the proposed action, except along the proposed product pipeline to Roosevelt, Utah. The product pipeline would cross 80 acres of irrigated cropland between Ouray and Roosevelt where alfalfa hay, native hay, small grains, and some corn are the main crops grown.

Cropland, including prime agricultural land in the Ashley Valley, Pelican Lake and Roosevelt areas, would be affected by land use conversion for homesites and related urban development which would accommodate the projected Magic Circle population increase. For a description of croplands that would be affected, refer to Section R-3.A.6, Agriculture.

Grazing

Livestock grazing is authorized on all state, BLM, and Uintah and Ouray Indian Reservation land that would be occupied by the project. The BLM has established grazing allotments that include state and private lands which are administered under an exchange of use agreement by the BLM (Wright 1982). The proposed action would cross four BLM grazing allotments that contain 30,000 AUMs of forage and would support 6,000 head of cattle or 30,000 sheep (BLM 1981b). The product pipeline to Roosevelt would cross the Uintah and Ouray Indian Reservation and affect four grazing allotments that contain 571 AUMs of forage with 94 head of livestock permitted (BIA 1981).

M-3.A.7 TRANSPORTATION NETWORKS

The transportation networks that would be affected by the Magic Circle project are described in Section R-3.A.7, Transportion Networks.

M-3.A.8 RECREATION

There are no developed outdoor recreation facilities or intensively used outdoor recreation areas at the proposed project area. The types and amount of this type of recreation use occurring in Uintah County, which includes this project area, is provided in Section R-3.A.8, Recreation.

Undeveloped-type recreation opportunities in the project area are basically limited. There is a small, unquantified amount of off-road vehicle (ORV) use. Hunting is considered limited and incidental for small game; however, the proposed product pipeline to the Plateau Refinery (Roosevelt, Utah) and the water pipeline would cross waterfowl hunting areas, particularly at the confluence of the White and Green rivers and along a 2-mile segment of the Green River (approximately 2 miles southwest of the Ouray National Wildlife Refuge). The product pipeline would also pass to the north of the Bottle Hollow Reservoir and campground area. The reservoir, managed for the Uintah

and Ouray Indian Reservation by Bottle Hollow Enterprises, provides opportunities for trout fishing, boating, water skiing, and vehicle hook-ups and tent camping. There are 90 camping units at the Bottle Hollow Reservoir campground (Uintah and Ouray Agency 1982). The other proposed product pipeline, which would tie into the Western Crude Oil pipeline east of Bonanza, Utah, would pass a deer hunting area at the crossing of the White River. Both the White and Green rivers possess values that have been identified as being nationally significant and which may be eligible for study and possible future inclusion into the National Wild and Scenic Rivers Systems (HCRS 1981).

Other forms of dispersed recreation (such as camping, sightseeing, and hiking) are limited within the project area due to low quality experiences associated with these recreational opportunities.

Municipal and county recreation facilities that could be affected by population increase due to implementation of this project are described in Section R-3.A.8, Recreation.

M-3.A.9 CULTURAL RESOURCES

Prehistory

The Magic Circle project lies within the Uinta Basin of the Colorado Plateau, as described in Section R-3.A.10, Cultural Resources. Portions of the Magic Circle project area have been surveyed for cultural resources.

The spent shale disposal area, plant site, catchment dams, and a 4-mile wide utility corridor were surveyed by Brigham Young University. Four prehistoric sites were located and recorded. Although there were no diagnostic artifacts found within any of the sites, three are located in sandy (sand dune) areas and may be associated with the Archaic period. Site 42 UN 1112 is located in deep soil on a side of a knoll in a broad wash. Additional work on this site revealed that it was not significant and therefore ineligible for listing on the National Register of Historic Places. (Thompson 1981)

The National Register of Historic Places and the State Register of Historic Sites were consulted during the surveys. No previously recorded sites of National or State Register quality have been reported in the Magic Circle project area. (Thompson 1981)

History

The general history of the area is contained in Section R-3.A.10, Cultural Resources. One historic site was located on the Magic Circle project area during the survey by Brigham Young University. Site 42 UN 1109 is a gilsonite mine which contains the remains of two mine shafts. The artifacts associated with the site indicate the mine is post-1930 and therefore not considered significant. (Thompson 1981)

M-3.A.10 VISUAL RESOURCES

The proposed project would be developed within the Colorado Plateau physiographic province. Locally, the landform is mostly a desert plateau with low rolling hills and occasional deep drainage patterns segmented by the White and Green rivers. Vegetation consists of mixed-desert shrub with interspersed riparian zones. The area is generally uninhabited, but contains a high degree of cultural modifications through the presence of oil and gas activities, numerous roads, and community development along the product pipeline to Roosevelt, Utah.

The project area consists of three Visual Resource Management (VRM) classes. Class II extends along the White River for approximately 0.5 mile on either side of the river. Class III extends along the Green River for approximately 0.5 mile on either side and along Willow Creek for approximately 1 to 2 miles on either side of the main stream. The remainder of the project area is categorized as VRM Class IV (BLM 1981a; BLM 1982b). Refer to Appendix R-H, Visual Resource Management Methodologies, for an explanation of VRM classes.

The project would affect the existing visual environment in only a limited number of places. The project area is not generally viewed from highly sensitive areas, other than from the two rivers, the County Road "B," or the product pipeline to Roosevelt, which can be viewed from more inhabited areas toward the northern end. Additionally, the scenic quality tends to be less diverse than other portions of the region, leading to a less restrictive VRM class rating. To summarize, approximately 47 acres of VRM Class III areas and 7 acres of VRM Class IV areas would be affected by the proposed action. Refer to Section R-4.A.11, Visual Resources, for an explanation of the methodology used to determine areas in which the visual resources would be affected.

Existing visibility conditions are discussed in Section M-4.A.2, Air Quality.

M-3.A.11 MINERAL AND ENERGY RESOURCES

The mineral and energy resources underlying the 10,254-acre lease area throughout the Uintah Basin. These resources are identified in Section R-3.A.13, Mineral and Energy Resources.

M-3.A.12 EXISTING LAND USE PLANS

The land use constraints for the Magic Circle project are identified in Section R-3.A.14, Existing Land Use Plans.

M-3.B <u>ALTERNATIVES</u>

The affected environment for the alternatives would be similar to that described for the proposed action. See Table M-1-2 (Section M-1.F) for differences in the acreages of land that would be disturbed during construction.

Environmental consequences are those impacts resulting from implementing the proposed action or any of the alternatives. In this chapter, impacts are discussed in a level of detail that corresponds to the severity of impact. Thus, the most significant impacts are discussed in the most detail. The following resources would not be significantly affected by the proposed action or alternatives and, therefore, are not discussed further.

- Paleontology
- Wilderness - no Wilderness Areas or any areas under formal wilderness review, study, or appeal would be directly or indirectly affected by the proposed action or alternatives.

M-4.A **PROPOSED ACTION**

M-4.A.1 SOCIOECONOMICS

Population and Employment

Development of the Magic Circle project would cause the population of Uintah and Duchesne counties and the Colorado area to increase by 5,083 people in 1986 (peak construction) and 5,839 people in 1987 (peak operation).

Most of the socioeconomic impacts would occur in Uintah County and to a lesser extent, Duchesne County. Spillovers to the Colorado area would be minimal with less than 1 percent increase over baseline in 1988. The community of Dinosaur, however, would experience a greater population increase over baseline.

In 1986, Uintah County's population growth over baseline would be 13.9 (3,692 persons) percent. The increase over baseline in 1988 would be 14.1. percent (3,937 persons). Duchesne County's respective increase would be 7.0 percent (1,268 persons) and 9.4 percent (1,745 persons). The community of Vernal would have the greatest absolute increase in population. Percent increase over baseline would be 14.3 percent (1,388 persons) in 1986 and 18.2 percent (1,891 persons) in 1988. Dinosaur would also have an increase over baseline, with growth of 12.3 percent (54 persons) in 1986 and 17.4 percent (69 persons) in 1988. Roosevelt would have similar increases of 13.4 (753 persons) and 17.5 percent (1,041 persons), respectively. Myton and Ballard would have population increases, but of a much smaller magnitude.

Uintah County would receive the majority of employment increases, with growths over baseline of 25.2 percent (2,730 persons) in 1986 and 22.5 percent (2,542 persons) in 1988. Uintah County would also have the greatest increase in housing demand, along with the community of Vernal. In 1985, housing demand be 11.1 percent (880 households) over baseline for Uintah County and 13.2 percent (423 households) for Vernal. In 1988, the respective percentage would

be 14.9 and 17.3 percent. Considering the existing low vacancy rate in these areas, housing shortages likely would occur, and temporary housing or modular developments would be probable.

Housing

Duchesne County would be affected to a lesser degree in terms of housing, but in 1988, demand would exceed baseline by 9.9 percent (87 households). The community of Roosevelt, however, would have significant increases in demand, reaching 18.5 percent (323 households) in 1988. Housing shortages also would result from the increases in housing demands in these areas.

Personal Income

Total personal income produced by the development of the Magic Circle project would be $85.6 million (1980 dollars) in 1986 and $78.4 million in 1988.

Education

Uintah County would be most affected. Demand above baseline for classrooms and teachers would be 9.0 percent in 1986 and 19.3 percent in 1988. Expansion of the school system would be needed.

Health

Uintah County would be most affected. There would be a demand for 8 additional hospital beds (14.3 percent increase over baseline); 3 additional physicians (11.5 percent increase over baseline); and 9 additional nurses (12.2 percent increase over baseline) by 1988. Impacts would be very similar for Duchesne County.

Mental Health

In the Duchesne-Uintah County service area, the major impact would be on the need for social workers. There would be a demand for one additional social worker in 1988.

Law Enforcement

Uintah County would experience the greatest impacts. There would be a demand for four additional police officers (12.1 percent increase over baseline) and one additional police car in 1988.

Sewers

Vernal would incur the greatest increase in sewer demand. In 1988, sewer demand would increase by 18.1 percent over baseline. This increased demand would be handled if the proposed sewer system is constructed on schedule. Dinosaur also would have substantial increases in demand. It is not known whether the raw sewer system being constructed would have adequate capacity to meet this demand.

Water

Vernal would have the greatest increased demand, though Dinosaur would also have a significant increase relative to baseline demand. Vernal's water demand (connections) would increase by 18.1 percent over baseline in 1988. Expansion of the existing water system would be needed; however, the planned water expansion project would have more than adequate capacity to handle the increased demand. Dinosaur would have increased demand, but likely would fill this demand with an increase in well permits.

Uintah and Ouray Indian Reservation

The Magic Circle project would be located adjacent to the reservation and would involve product pipeline and water supply pipeline crossings over the reservation. The Ute Tribe would experience several primary and secondary effects which are described in detail in Section R.4.A.1, Socioeconomics. The impacts due to construction and associated labor force would be most pronounced within the reservation. Effects stemming from presence of a large temporary work force, employment of Ute tribal members, and stresses upon tribal infrastructure would occur.

Quality of Life

The local social consequences associated with the implementation of this proposal would be significant in Duchesne and Uintah counties, Utah. These changes would be similar to those described under the regional high-level scenario (Section R-4.A.1, Socioeconomics), except they would be of a much lower level of intensity.

M-4.A.2 AIR QUALITY

Estimated increased pollutant concentrations are compared to the Prevention of Significant Deterioration (PSD) incremental limitations and National Ambient Air Quality Standards (NAAQS) in Tables M-4-1 and M-4-2. Except for total suspended particulates, all pollutant concentrations are predicted to be within the NAAQS and PSD incremental limitations. Table M-4-2 shows that maximum 24-hour average concentrations would violate the NAAQS for particulates. The baseline total suspended particulates concentrations are predicted to exceed the NAAQS, mainly from dust due to vehicular traffic on

TABLE M-4-1

COMPARISON OF MAXIMUM INCREASED POLLUTANT CONCENTRATIONS WITH PSD INCREMENTAL LIMITATIONS

PSD Increments/Increment Consumption	SO_2 Concentration[a] (ug/m^3) 3-Hour Average	SO_2 Concentration[a] (ug/m^3) 24-Hour Average	SO_2 Concentration[a] (ug/m^3) Annual Average	TSP Concentration[b] (ug/m^3) 24-Hour Average	TSP Concentration[b] (ug/m^3) Annual Average
Class II Areas					
Allowable PSD Class II increment	512	91	20	37	19
Magic Circle increment consumption	121	32	1	less than 32	less than 4
Increment consumption including baseline	129	33	1	less than 32	less than 4
Magic Circle increment consumption at Uintah and Ouray Indian Reservation	10	1	0	less than 32	less than 4
Increment consumption at Uintah and Ouray Indian Reservation including baseline	16	2	0	less than 33	less than 4
Class I Areas					
Allowable PSD Class I increment	25	5	2	10	5
Increment consumption at Flat Tops Wilderness Area (federal Class I)					
Magic Circle increment consumption	0	0	0	0	0
Increment consumption including baseline	0	0	0	0	0
Increment consumption at Maroon Bells-Snowmass Wilderness Area (federal Class I)					
Magic Circle increment consumption	0	0	0	0	0
Increment consumption including baseline	0	0	0	0	0

TABLE M-4-1 (Concluded)

COMPARISON OF MAXIMUM INCREASED POLLUTANT CONCENTRATIONS WITH PSD INCREMENTAL LIMITATIONS

	SO_2 Concentration[a] (ug/m^3)			TSP Concentration[b] (ug/m^3)	
PSD Increments/Increment Consumption	3-Hour Average	24-Hour Average	Annual Average	24-Hour Average	Annual Average
Increment consumption at Dinosaur National Monument (Colorado Category I and potential federal Class II)					
Magic Circle increment consumption	1	0	0	0	0
Increment consumption including baseline	3	0	0	0	0
Increment consumption at Colorado National Monument (Colorado Category I and potential federal Class II)					
Magic Circle increment consumption	0	0	0	0	0
Increment consumption including baseline	0	0	0	0	0

Note: For more information on the models used in this analysis, refer to Appendix R-I.

SO_2 = sulfur dioxide; TSP = total suspended particulates; ug/m^3 = micrograms per cubic meter.

[a]Calculated using SAI Gaussian Puff Model (GPM) with 5-kilometer grid spacing.

[b]Class II increment calculated using EPA Complex I Model with a 1-kilometer grid spacing; Class I consumption calculated using the SAI Gaussian Puff Model with a 5-kilometer grid spacing.

TABLE M-4-2

COMPARISON OF MAXIMUM GROUND-LEVEL POLLUTANT CONCENTRATIONS WITH THE NATIONAL AMBIENT AIR QUALITY STANDARDS (NAAQS)

	Maximum Ground-Level Concentration (ug/m^3)			
Pollutant / Averaging Time	Baseline[a]	Magic Circle Impact[b]	Total[c]	NAAQS (ug/m^3)
Sulfur dioxide (SO_2)				
3-Hour	185	121	306	1,300
24-Hour	23	32	55	365
Annual	0	1	1	80
Total suspended particulate (TSP)				
24-Hour	222	less than 32	less than 254	150
Annual	55	less than 4	less than 59	60
Nitrogen dioxide (NO_2)				
Annual	1	6	7	100
Carbon monoxide (CO)				
1-Hour	200	44	244	40,000
8-Hour	200	44	244	10,000
Ozone (O_3)				
1-Hour	70	2	72	240
Hydrocarbons (HC)				
3-Hour	100	3	103	160

Note: For more information on the models used in this analysis, refer to Appendix R-I. ug/m^3 = micrograms per cubic meter.

[a]CO, HC, and O_3 estimated from air quality monitoring data; TSP estimated from Empiricial Model; SO_2 and NO_2 estimated from dispersion modeling.

[b]Calculated using SAI Gaussian Puff Model with 5-kilometer grid spacing, except TSP concentrations, which were estimated using EPA Complex I Model with 1-kilometer grid spacing.

[c]It is conservatively assumed that baseline maximum and Magic Circle maximum coincide.

dirt roads and wind raised soil particles. The additional concentrations added by the Magic Circle project would exacerbate the high existing levels. The Air Quality Technical Report (System Application Inc. 1982) contains isopleths of increased 3-hour, 24-hour, and annual sulfur dioxide concentrations and 24-hour and annual total suspended particulates concentrations.

The potentials for atmospheric discoloration at Dinosaur National Monument and the Uintah and Ouray Indian Reservation were calculated. The results predicted a faintly visible yellow-brown atmospheric discoloration would be observed at Dinosaur Visitors Center from 5 to 30 mornings and 1 to 10 afternoons per year, depending on the sensitivity of the observer. A faintly visible yellow-brown discoloration would be visible an estimated 4 to 33 mornings and 1 to 25 afternoons per year at the Uintah and Ouray Indian Reservation. The discoloration could also be visible in the vicinity of the facility during some conditions, especially clear stable mornings with light wind speeds.

Additional visibility analyses indicated reduction in visual range would not be significant at any potential or existing Class I area based on the significance criteria given in Chapter R-4. For more detailed information on the visibility analysis, refer to Appendix R-G or the Air Quality Technical Report (Systems Applications Inc. 1982).

M-4.A.3 WATER RESOURCES

Surface Water

The Magic Circle operation would be a zero discharge process, therefore the processing facilities would not alter the quality of any water supply. However, erosion during construction would contribute additional sediment to streams. This would be a temporary and insignificant impact. The 540 ac-ft/yr that Magic Circle proposes to withdraw from the Green River at its confluence with the White River represents 0.01 percent of the average annual flow of the Green River and 0.1 percent of the White River. Withdrawal of these amounts would not represent a significant impact.

Product pipeline stream crossing construction would be undertaken during periods of low flow. Because of this and the low flow types of streams that would be crossed, impacts are expected to be minimal. Typically, suspended sediment levels would increase directly downstream from the crossing; however, they would return to background levels after construction.

Floodplains

Impacts associated with construction in floodplains are discussed in Section R-4.A.3, Water Resources.

Ground Water

The proposed mine shafts may encounter a permeable zone of the Birds Nest aquifer and would require dewatering during construction. The effect would be temporary and probably would not extend to the boundaries of the mine property. The mine, 300 to 500 feet below the Birds Nest, might encounter a large open fracture or fracture zone extending to the Birds Nest aquifer. Any water entering the mine would be used to augment the water supply.

M-4.A.4 VEGETATION, SOILS AND RECLAMATION

The acreages of vegetation and soils that would be disturbed and occupied by the proposed project and alternatives are listed in Table M-4-3.

Vegetation

Vegetation removed during construction of surface facilities would result in that land being taken out of production for the life of the project (30 years). Temporary disturbance would occur through construction of pipelines, power transmission lines, roads, and spoil areas, as well as areas adjacent to buildings and spent shale piles.

Reclamation measures outlined by the company and summarized in Appendix R-J could return vegetation to near preconstruction densities within 10 years after implementation of the measures. From 20 to 75 years would be required to return brush and tree species to preconstruction height and population densities. With successful revegetation, impacts would be considered negligible to vegetation cover.

Ground cover under existing conditions ranges from 10 to 25 percent, which is an indicator of poor growing conditions. Should adverse growing conditions persist at the time of revegetation, noxious weeds (such as halogeton) would become established, making further revegetation efforts with desirable species difficult. These conditions would cause significant limits to reestablishing native vegetation.

Increased off-road vehicle usage from anticipated population increases could cause significant secondary impacts by the uprooting and crushing of vegetation, which would cause loss of production and soil cover.

A federally designated threatened plant, the hookless cactus (Sclerocactus glaucus), has been identified within the project area. Proposed linear rights-of-way would cross habitat on the Uintah and Ouray Indian Reservation near the confluence of the Green and White rivers that is similar to habitat occupied by the hookless cactus. Consultation procedures related to Section 7 of the Endangered Species Act have been initiated with the U.S. Fish and Wildlife Service.

TABLE M-4-3

SUMMARY OF SURFACE AREA DISTURBED, OCCUPIED, RECLAIMED, GRAZING AND CROPLAND AFFECTED BY PROJECT COMPONENT

Project Components	Total Area Disturbed (Miles)	Total Area Disturbed (Acres)	Area Occupied for Project Life - 10 to 30 Years (Acres)	Area Reclaimed and Revegetated[a] (Acres)	Potential Grazing Losses[b] AUMs[c]	Potential Grazing Losses[b] Livestock Numbers[d]	Cropland Affected (Acres)	Prime Agri-cultural Land (Acres)
Proposed Action:								
Plant Site and Related Facilities[e]	NA	200	200	0	13	3	0	0
Spent Shale Disposal Area[f]	NA	1,880	1,880[g]	1,880[h]	125	25	0	0
Retention Ponds	NA	55	55	0	4	1	0	0
Roads								
Access	0.75	6	4	2	0	0	0	0
Water Supply System								
Green River	12.5	10	0	10	0	0	0	0
Power Supply System	5	33	0	33	2	1	0	0
Product Pipeline								
To Roosevelt	40	140	0	140	10	2	80	55
Batch Station at Chevron	NA	30	30	30	2	0	0	0
To Bonanza	25	77	0	77	5	1	0	0
Construction Camp	NA	60	60	60	4	1	0	0
TOTAL		2,491	2,229	2,232	165	34	80	55
Off-site Home Sites and Related Urban Development[i]	NA	NA	NA	NA	0	0	1,285	385
Alternatives:								
Power Supply System	3.5	23	0	23	2	2	0	0
Green River Water Supply System	12.5	10	0	10	0	0	0	0
White River Water Supply System	12.5	10	0	10	0	0	0	0

Note: Components of the Paraho Process Alternative and On-site Wells Alternative would be located within the proposed mine and plant site. No off-site water pipeline would be required for the On-site Wells Alternative.

[a]Considered temporary disturbance except for spent shale disposal area.

[b]Linear construction disturbance would be revegetated. No grazing losses would occur unless the right-of-way would be fenced.

[c]AUMs computed at average rate of 15 acres per AUM for all land ownerships. For a period of 5 years, there is a loss on reclaimed acreage, because restoration takes 5 years.

[d]Livestock numbers are based on a 3-month grazing season. One unt = 1 cow or 1 horse or 5 sheep. (Source: BLM Grazing Records. Vernal, Utah)

[e]Includes parking lots, electrical power distribution lines, conveyors.

[f]Includes surface water runoff retention ponds, solid and hazardous waste disposal.

[g]Disturbance would consist of removal of surface layers for use in reclamation of spent shale disposal area.

[h]Reclamation of spent shale would be conducted concurrently with operations. Approximately 75 acres per year would be reclaimed.

[i]Cropland converted to urban uses due to project-related population increases in the Pelican Lake and Ashley Valley areas.

Soils and Reclamation

Soil loss resulting from accelerated wind and water erosion caused by activities associated with construction of linear corridor facilities would occur until erosion control measures are implemented (1 year). Impacts to soils would be considered temporary and insignificant, because soil loss is expected to be minimized and revegetation successful with implementation of the erosion control and revegetation procedures outlined by Magic Circle (Appendix R-J). However, impacts to soils would be significant if applicable erosion control measures are not implemented due to lack of compliance with approved plans or if adverse weather conditions (mainly heavy rainstorms) would occur during construction before any erosion control measures could be installed. A few small unquantifiable areas (mainly abrupt steep slopes along the linear facility corridors) would require continuing follow-up measures.

Disturbance associated with the spent shale disposal area would occur on 1,880 acres. This disturbance would occur concurrently with project operations and the acreage would be removed from production for the life of the project (30 years). Reclamation of the spent shale disposal area would be accomplished in stages concurrently with project operations. The surface of the spent shale area would be shaped, stabilized and made suitable for plant growth by reclamation measures and procedures outlined by Magic Circle's reclamation program. This program also calls for covering the spent shale with topsoil and soil materials suitable for plant growth which would minimize the problems of making the spent shale pile surface favorable for revegetation. Refer to Appendix R-J and Section R-4.A.4, Vegetation, Soils, and Reclamation for more detailed discussion concerning availability, placement and maintenance of soil materials suitable for plant growth in spent shale disposal area reclamation. Reclamation and erosion control is expected to be successful based on intensive implementation of the applicable measures outlined by Magic Circle and from the demonstrated results of current field studies (Appendix R-J).

M-4.A.4 WILDLIFE

Habitat

This project would result in direct and indirect losses of wildlife habitat. Direct losses of habitat would total an estimated 2,491 acres (2,169 acres covered by facilities, 322 acres on rights-of-way) (Table M-4-3). Of these direct habitat losses, an estimated 2,169 acres would be lost for the life of the project. Other losses of habitat would include those acres that are not physically destroyed or modified but are near project facilities to become temporarily unusable by wildlife because of isolation, dust, noise, and similar factors. These acres cannot be estimated at present levels of knowledge. The long-term loss of an estimated 2,169 acres of habitat represents less than 1 percent of the available habitat in this area.

The 289 acres that would be reclaimed after constructon would be seeded to a mixture of grass and shrubs adapted to the area. The grasses would probably establish themselves within 3 to 5 years, while the shrub species may take 20 years or more to become established. Thus, the resulting pure grass stand

would change the habitat character of the area and might induce grass-dwelling species to infiltrate into an area where they presently do not occur.

Impacts to vegetative habitats during peak construction (1986) and peak operation (1988) are not expected to be significantly different from each other.

Wildlife Populations

Wildlife populations on the project area would be lost or reduced with the advent of this project. Losses would be caused directly by project construction and operation or indirectly by increased poaching, wanton killing, and harassment.

Project development in the high priority pronghorn antelope range could cause a population reduction because of harassment. Construction and operation activities could displace pronghorn antelope into adjacent areas where essential habitat components are not found, causing stress and a potential population reduction. The high priority value range in the vicinity of this project totals an estimated 346,199 acres, with the project disturbing about 2,491 acres or about 0.7 percent of this critical habitat. Estimates of population losses based upon this reduction in habitat cannot be reliably estimated at this time, but they are not expected to be significant.

Removal of topsoil and storage for later reclamation, construction of ancillary facilities, and upgrading of access roads would cause direct mortality to small burrowing rodents. Small animal losses on an estimated 2,169 acres would be heavy, but the high reproductive potential of these species indicate repopulation on rehabilitated areas would be rapid. The revegetation of disturbed areas to a grass complex could result in a different small mammal population, since small rodents that frequent shrub habitat would not infiltrate back into an area replanted to grass (BLM 1978c).

Mourning doves feed and nest on most of the proposed site, but habitat is marginal because of the uniformly poor quality of habitat throughout the area. No data exist on nesting dove populations, but 2,169 acres of poor quality nesting and feeding habitat would be lost over the life of the project. This habitat and estimated production loss is assumed to be less than 1 percent of the Uintah County dove population.

Approximately 277 acres of the substantial value, year-long sage grouse habitat would be disturbed by project activities. An estimated 217 acres would be covered by spent shale disposal and would be lost over the long term. The construction camp would cover about 60 acres, and vegetative habitats would be lost on these acres for about 10 years. Unless the sage grouse habitat south of this area is below carrying capacity, the grouse displaced by the project could be lost, thus reducing the overall population by an unquantifiable amount.

Some small nongame songbirds would be lost or displaced by the loss of 2,169 acres of mixed-desert shrub habitat. The best available population density

estimate for the project area is an average of 21 breeding pairs per 100 acres (BLM 1978c). Thus, 455 small bird breeding pairs would be theoretically lost due to project construction and operation. It is anticipated that these losses would be less than 1 percent of the Uintah County population.

Raptors could be adversely affected by this project by the elimination of 2,169 acres of prey habitat. Some nesting habitat for ground nesting raptors (such as marsh hawks and ferruginous hawks) would also be lost for the life of the project. Losses are not expected to be significant, however, as there appears to be ample nesting and foraging habitat throughout the areas adjacent to the project.

Direct losses of reptiles on 2,169 acres for the life of the project and displacement on the same number of acres would total an estimated 1 percent or less of the regional population. Reproduction of these species is high enough that repopulation would be rapid once the project is abandoned.

The small amount of riparian habitat (18 acres) disturbed by this project would have no appreciable effect upon amphibian populations.

Withdrawal of water from the Green River via 4 alluvial wells is not anticipated to adversely affect the endangered fish species, since there would be no in-river diversion structure to cause impingement problems. However, the actual reduction in flow to the Green River is anticipated to cause adverse impacts to endangered fish habitat. The Fish and Wildlife Service is being consulted regarding the flow reduction (an estimated 0.04 percent of the average annual flow of the Green River and 0.4 percent of the average annual flow of the White River) and its impact to endangered fish species.

Impacts to the razorback sucker, which is a declining species in Utah, are not projected for this project, since water would be supplied from alluvial wells and not from diversion structures in the river.

M-4.A.6 AGRICULTURE

Cropland

Anticipated population increases (5,839 people by 1988) and project associated support facilities would cause significant impact to land use through the conversion of cropland, including prime agricultural land, to other uses, especially in the nearby areas of Ashley Valley, Pelican Lake, and Roosevelt, Utah. An estimated 1,285 acres of cropland, including prime agricultural land, would be converted to homesites and other related urban development to support population increases from the proposed Magic Circle project. This land use conversion would contribute to the loss of cropland in the region, as discussed in Section R-4.A.4, Vegetation, Soils, and Reclamation.

Construction of the product pipeline to Roosevelt would disturb 80 acres of cropland (Table M-4-3) for one growing season. Impacts to cropland due to pipeline construction would be insignificant and short-term (1 to 2 years),

because restoration is expected to be successful with the implementation of the erosion control and reclamation procedures proposed by Magic Circle (Appendix R-J).

Grazing

The proposed surface structures would remove vegetation and its productive capacity for the life of the project (30 years). With successful reclamation procedures, an additional 5 to 20 years would be required to restore the area to preconstruction densities. Where construction in linear rights-of-way would disturb vegetation, productive capacity would be restored to preconstruction levels within 3 to 10 years after implementation of the reclamation plans outlined by the applicant.

Loss of forage would total approximately 137 AUMs (Table M-4-3) or 0.05 percent of the affected allotments' carrying capacity for the 30-year life of the project. Twenty-three AUMs would be lost for 3 to 10 years from right-of-way construction. Fifteen of these AUMs would occur on lands within the Uintah and Ouray Indian Reservation (BIA 1981).

Significant secondary impacts could occur from livestock road kills and from disruption of traditional grazing patterns, which could cause animal weight loss. Under these conditions, a rancher might abandon use of a grazing area or allotment, which could cause that operation to go out of business. The final analysis would depend upon the degree of vehicular travel on roads, construction activity, off-road vehicle use, and recreational pursuits. See Table M-4-3 for miles and acres that would be disturbed by project components.

M-4.A.7 TRANSPORTATION NETWORKS

Development of the Magic Circle project would have an adverse impact on some roads in the Uintah baseline based on traffic projections made for 1986 and 1988, the peak construction and operation years. The largest impact would be on U.S. 40, where the sections from the county line to County Road 264, State Route 88 to Vernal, and Vernal to Jensen would reach unacceptable levels by 1988. The level of service would be reduced to Level D (American Association of State Highway and Transportation Officials 1965). This means traffic flow would fluctuate in volume and would have temporary restrictions to flow, which could cause substantial drops in operating speeds. Information on volume-to-capacity calculations and level of service is discussed in more detail in the Socioeconomics Technical Report (State of Utah 1982b).

There is estimated to be an average of 4 truck trips per day to transport construction equipment. The most likely routing would be from Vernal to SR 88 and south to the project site. During plant operation, approximately 2 truck trips per day were estimated to transport sulfur.

M-4.A.8 RECREATION

The implementation of the proposed project would directly disturb 2,491 acres of land from the recreation land base over the life of the project. Since dispersed recreation opportunities are limited within the project area, there would be relatively few impacts upon recreation use due to this disturbance.

The project would cause a population increase of 5,083 in 1986 (peak construction year) and 5,839 in 1988 (peak operation year). This increase would result in relatively little impacts to ORV use, camping, fishing, hunting, and other day-use recreational opportunities. ORV activity could increase during weekends. This could cause a proliferation of new unauthorized trails, resulting in resource protection problems (especially for soils, vegetation, wildlife, and cultural resources) for local federal land managers.

No impacts due to the population increase are anticipated upon municipal and county recreation opportunities in Roosevelt and Vernal, Utah, where the majority of the permanent work force is expected to reside. These communities have diverse recreation programs and should be able to accommodate the needs of the increased population.

The quality of canoeing and floatboating experiences at the proposed product pipeline crossing points of the White and Green rivers would have temporary, short-term (4 to 6 weeks) adverse impacts. The feeling of remoteness along the relatively undisturbed canyon and river banks, and the sounds of nature are river recreation values which could be affected by pipeline construction activity. However, because construction of river crossings would be of short duration (4 to 6 weeks) and would occur during the low-flow season (August through October) when use is at a minimum, these impacts upon recreational river running experiences would be insignificant.

The alluvial well structures and pump house that would be situated adjacent to the Green River would be anticipated to foreclose a one-mile segment of the Green River from possible future designation as a Wild and Scenic River. These permanent structures would create significant adverse visual impacts upon river recreational values (Federal Register 1980a; HCRS 1981).

Because hunting is considered limited and of low quality within the project area, no long-term adverse impacts would result. However, temporary, short-term impacts (4 to 6 weeks) due to proposed product pipeline construction across the White and Green rivers may affect the hunting experiences for deer and waterfowl. Construction-related noise could disturb deer and waterfowl in riparian habitat zones along these rivers. Poaching and wanton killing of wildlife would likely increase (Bradley 1976). These hunting and wildlife impacts would not be significant due to the marginal quality of the wildlife and waterfowl along the river crossing points; there are several other nearby areas such as the Ouray National Wildlife Refuge and High Uinta Mountains with

much higher quality deer and waterfowl hunting experiences. Nonetheless, hunting is the primary recreational activity of this area (BLM 1973a) and enjoyed by a substantial number of hunters (see Section R-4.A.5, Wildlife, for further details).

The proposed product pipeline to Roosevelt, Utah, could also affect summertime recreation activities at the Bottle Hollow Reservoir, particularly along the north shore where camping opportunities are available. Construction-related noise and dust within 0.25 mile of recreation facilities could affect the quality of camping experiences and day use recreational activities. However, this construction activity would not be significant due to its short-term duration (4 to 6 weeks).

There are no details about the kinds of recreation facilities that would be available at the construction camp, where the majority of the construction work force would reside. Based on various studies and reports of existing construction camps, serious social problems could result unless these camps are properly developed (Davenport 1979). Therefore, careful planning and development is essential. Unauthorized hunting, fishing, and ORV use, especially on the Uintah and Ouray Indian Reservation, which is adjacent to the construction camp, likely could occur.

M-4.A.9 CULTURAL RESOURCES

The Magic Circle project would cause land modifications that could affect cultural resources as described in Section R-4.A.10, Cultural Resources.

The state lease lands and a portion of the rights-of-way for the Magic Circle project have been surveyed for cultural resources in compliance with 36 CFR 800, E.O. 11593 and other historic preservation legislation. The remaining rights-of-way will have to be surveyed and evaluated for significant cultural resources.

M-4.A.10 VISUAL RESOURCES

The visual resource of the areas that would undergo significant adverse impacts as a result of the proposed action and alternatives (including the total number of acres that would be affected) are summarized in Table M-4-4. The placement of the project in these areas would exceed the allowable levels of contrast for each VRM class established for specific portions of the project area. Areas where impacts would exceed the acceptable levels of contrast for a specific VRM class are placed in VRM Class V (indicating rehabilitation would be necessary to meet the objectives of the existing VRM class). Refer to Section R-4.A.11, Visual Resources, for a description of the criteria used to determine significance of visual resource impacts which would occur if the project were constructed.

TABLE M-4-4

SIGNIFICANT ADVERSE VISUAL RESOURCE IMPACTS

COMPONENT	VRM CLASS	ACRES SIGNIFICANTLY AFFECTED	LOCATION OF IMPACTS	EXPLANATION
Proposed Action				
Water Supply System	III	2[a]	0.5 mile along the Green River (long-term); within right-of-way	Contrast in vegetation clearing for pipeline; contrast in structure of wells as seen from Green River.
Power Transmission Line	IV	7	0.5 mile each side of County Road "B" (long-term construction and operation); within right-of-way	Contrast in vegetation clearing, structures as viewed from County Road "B".
Product Pipelines Pipeline to Roosevelt Pipeline to Bonanza				
	III	7[a]	3 miles where pipeline crosses Green River three times (long-term); within right-of-way	Construct in vegetation clearing for pipeline as viewed from the Green River
	III	3	0.5 mile each side of White River (long-term); within right-of-way	Contrast in vegetation clearing along White River.
	III	35[a]	15 miles along portion of pipeline from Roosevelt toward plant site (long-term); within right-of-way	Contrast in vegetation clearing for pipeline as viewed from Roosevelt, rural residential area.
Alternative				
Green River Water Supply System	III	2[a]	0.5 mile along the Green River (long-term); within right-of-way	Contrast in vegetation clearing for pipeline; contrast in structure of wells as seen from the Green River.
White River Water Supply System	II	2	0.5 mile along the White River (long-term); within right-of-way	Contrast in vegetation clearing for pipeline; contrast in structure of wells as seen from the White River.

NOTE: There would be no VRM impacts for the Alternative Power Transmission Line, Small-Scale Paraho Process Alternative, or On-Site Wells Alternative Water Supply System.

[a]All acres significantly affected would be located on the Uintah and Ouray Indian Reservation.

M-4.A.11 MINERAL AND ENERGY RESOURCES

Over the life of the project, 70,000 tons per day of oil shale would be mined and processed to produce 31,500 barrels per day of shale oil. The net energy balance for the Magic Circle project was computed on the basis of this level of production in a surface processing system. The modified in-situ process, which would increasse production to 100,000 barrels of shale oil per day, was not considered.

It was necessary to assume several needed parameters and capacities in the net energy analysis, which could explain why the overall efficiency of the Magic Circle proposal is somewhat low.

The methodology used to determine the following figures is discussed in Section R-4.A.13, Mineral and Energy Resources, and Appendix R-L.

	Trillion Btu's/Year
Net Output	61.260
Energy in Shale	(111.400)
Other Fuels Used	(3.035)
Indirect Energy	(20.049)
Infrastructure	(18.660)
Total Input	153.140
Percent Efficiency	42.6 percent

This figure is on the same order of magnitude that could be expected from coal-fired electric power generation or producing oil by pumping a well.

M-4.A.12 EXISTING LAND USE PLANS

As shown on Map R-A-3 (located in Appendix R-A), 9.5 miles of the proposed product pipelines and 2.5 miles of the water pipeline would be located outside a designated corridor on federal land. About 29 miles of the product pipeline to the Plateau Refinery (Roosevelt, Utah) and 10 miles of the water pipeline would be located within the Uintah and Ouray Indian Reservation.

The project area is currently zoned for mining and grazing under the Uintah County zoning ordinance. The county is presently developing a new land use master plan. The plan will likely consider the proposed energy development plans and not present constraints prohibiting the orderly development of the Magic Circle project.

The Ute Tribe of the Uintah and Ouray Indian Reservation is in the process of assessing the land use potential of their reservation. A land use plan will probably be developed for the reservation in the near future. The plan could contain specific constraints dealing with right-of-way corridors and land uses

which may conflict with the proposed water and product pipelines. Any conflicts would have to be resolved between Magic Circle and the tribe.

M-4.B SMALL-SCALE PARAHO PROCESS ALTERNATIVE

Under this alternative, the Small-Scale Paraho Process would be a substitute for the proposed improved NTU/T3 retort process. Because no additional acres would be disturbed, the impacts to all resources except air quality and water resources would be the same as for the proposed action.

By using the small-scale Paraho retorting process, air emissions would be different than those identified for the proposed action, retorting process. (Emissions rates for both processes are identified on Table M-1-5.) Except for hydrocarbon emissions which would increase by a factor of 6 (though still remaining quite small), other emissions would decrease--sulfur dioxide by 3 percent, particulate matter by 29 percent, nitrogen oxides by 8 percent, and carbon monoxide by 60 percent. Thus, overall emissions from the Magic Circle plant site would be somewhat lower, as would air quality impacts, as a result of the small-scale Paraho process alternative. Air quality impacts of this alternative are summarized in Tables M-4-5 and M-4-6, which shows that no NAAQS or PSD increments would be exceeded, except for the NAAQS for particulates which are exceeded at the baseline level due primarily to dust from unpaved roads. Visibility impacts would be similar to those for the proposed action, but slightly less due to decreased particulates and nitrogen oxide emissions.

The increase in water use for this alternative (2,842 ac-ft) as compared to the proposed retort process (540 ac-ft) would increase the depletion from the White and/or Green rivers.

M-4.C ON-SITE WELLS ALTERNATIVE WATER SUPPLY SYSTEM

Under this alternative, water would be obtained from the Douglas Creek sandstone, an aquifer below the river horizon which (in some places) yields significant quantities of water. This alternative is only viable if this aquifer yields enough water at the Magic Circle plant site. Wells and pipeline for this water supply would be located on the proposed project area.

No additional surface disturbance would occur with this alternative. Consequently, effects to socioeconomics, air quality, vegetation, soils, wildlife, agriculture, transportation networks, recreation, wilderness, and cultural resources would be similar to those discussed for the proposed action. However, the effects to the visual resource would become insignificant as compared to the proposed action in that the river areas would not be entered and, therefore, no significant impacts would result. Also, because the energy requirements of this alternative would not vary significantly from those of the proposed action, the energy efficiency of the project would be essentially the same of this alternative were used.

TABLE M-4-5

SUMMARY OF PSD INCREMENT CONSUMPTION BY MAGIC CIRCLE RETORT ALTERNATIVE

PSD Increments/Increment Consumption	SO_2 Concentration[a] (ug/m^3) 3-Hour Average	24-Hour Average	Annual Average	TSP Concentration[b] (ug/m^3) 24-Hour Average	Annual Average
Class II Areas					
Allowable PSD Class II increment	512	91	20	37	19
Magic Circle increment consumption	117	31	1	less than 32	less than 4
Magic Circle increment consumption including basline	125	32	1	less than 34	less than 4
Magic Circle increment consumption at Uintah and Ouray Indian Reservation	10	1	0	less than 32	less than 4
Increment consumption at Uintah and Ouray Indian Reservation including baseline	25	5	2	10	5
Class I Areas					
Allowable PSD Class I increment	25	5	2	10	5
Increment consumption at Flat Tops Wilderness Area (federal Class I)					
Magic Circle increment consumption	0	0	0	0	0
Increment consumption including baseline	0	0	0	0	0
Increment consumption at Maroon Bells-Snowmass Wilderness Area (federal Class I)					
Magic Circle increment consumption	0	0	0	0	0
Increment consumption including baseline	0	0	0	0	0

TABLE M-4-5 (Concluded)

COMPARISON OF MAXIMUM INCREASED POLLUTANT CONCENTRATIONS WITH PSD INCREMENTAL LIMITATIONS

	SO_2 Concentration[a] (ug/m^3)			TSP Concentration[b] (ug/m^3)	
PSD Increments/Increment Consumption	3-Hour Average	24-Hour Average	Annual Average	24-Hour Average	Annual Average
Increment consumption at Dinosaur National Monument (Colorado Category I and potential federal Class II)					
Magic Circle increment consumption	1	0	0	0	0
Increment consumption including baseline	3	0	0	0	0
Increment consumption at Colorado National Monument (Colorado Category I and potential federal Class II)					
Magic Circle increment consumption	0	0	0	0	0
Increment consumption including baseline	0	0	0	0	0

Note: For more information on the models used in this analysis, refer to Appendix R-I.

SO_2 = sulfur dioxide; TSP = total suspended particulates; ug/m^3 = micrograms per cubic meter.

[a]Calculated using SAI Gaussian Puff Model (GPM) with 5-kilometer grid spacing.

[b]Calculated using EPA Complex I Model with 1-kilometer grid spacing, except Class I increment consumption which was calculated using GPM.

TABLE M-4-6

SUMMARY OF MAXIMUM AMBIENT AIR QUALITY IMPACTS OF MAGIC CIRCLE RETORT ALTERNATIVE COMPARED WITH APPLICABLE STANDARDS

Pollutant / Averaging Time	Maximum Ground-Level Concentration (ug/m^3) Baseline[a]	Magic Circle Impact[b]	Total[c]	NAAQS (ug/m^3)
Sulfur dioxide (SO_2)				
3-Hour	185	117	302	1,300
24-Hour	23	31	54	365
Annual	0	1	1	80
Total suspended particulate (TSP)				
24-Hour	222	less than 32	less than 256	150
Annual	55	less than 4	less than 59	60
Nitrogen dioxide (NO_2)				
Annual	1	6	7	100
Carbon monoxide (CO)				
1-Hour	200	17	217	40,000
8-Hour	200	17	217	10,000
Ozone (O_3)				
1-Hour	70	2	72	240
Hydrocarbons (HC)				
3-Hour	100	18	118	160

Note: For more information on the models used in this analysis, refer to Appendix R-I. ug/m^3 = micrograms per cubic meter.

[a] CO, HC, and O_3 estimated from air quality monitoring data; TSP estimated from Empiricial Model; SO_2 and NO_2 estimated from dispersion modeling.

[b] Calculated using SAI Gaussion Puff Model with 5-kilometer grid spacing, except TSP concentrations, which were estimated using EPA Complex I Model with 1-kilometer grid spacing.

[c] It is conservatively assumed that baseline maximum and Magic Circle maximum coincide.

However, water quality from this aquifer is generally poor and the water may need to be treated for certain uses. If this aquifer is sufficiently permeable for use effects should not be significant beyond the bounds of the site. In addition, because no surface water would be used under this alternative, no effects to surface water would exist.

This alternative would not conflict with any existing land use plans.

M-4.D WHITE RIVER ALTERNATIVE WATER SUPPLY SYSTEM

Under this alternative, water would be withdrawn from wells in the White River alluvium near its confluence with the Green River. Because the pipeline size and location would be identical to the proposed action, the impacts for all resources would be similar to those of the proposed action.

M-4.E GREEN RIVER ALTERNATIVE WATER SUPPLY SYSTEM

Under this alternative, water would be diverted from a different location on the Green River and would be transported via a 13-mile long pipeline which would follow the same route as the proposed action except for the last 3 miles (Map R-A-3 located in Appendix R-A). The length of the pipeline and acres disturbed by this alternative would be essentially the same as those associated with the proposed action; the two diversion points would be similar. Consequently, effects to all resources would be similar to those for proposed action.

This alternative would conflict with BLM's Rainbow Management Framework Plan (Section R-3.A.14, Existing Land Use Plans), because 3.5 miles of the pipeline would be located outside the designated right-of-way corridor. It would also cross 10 miles of the Uintah and Ouray Indian Reservation, which could be in conflict with the land use plan that the Ute Tribe is planning to develop in the near future.

M-4.F ALTERNATIVE POWER TRANSMISSION LINE

Under this alternative, a power transmission line would run from the main line proposed by Tosco (see Section T-1.D.2) to the Magic Circle plant site.

About 36 acres would be disturbed during construction of this line (3 acres more than the proposed action line). Because the area that would be affected by this alternative does not vary significantly from the area affected by the proposed action, impacts generally would be the same as the proposed action impacts. The only exception would occur to the visual resources, since the alternative would not cross a major river. Therefore, no significant impacts would occur to the visual resource as a result of this alternative.

M-4.G NO-ACTION ALTERNATIVE

Under this alternative, the requests for federal rights-of-way would be denied. Refer to the No-Action Alternatives section of the Site-Specific Analyses Introduction of this EIS for an explanation of the purpose of this alternative. Denial of the proposed federal rights-of-way would prohibit development of the Magic Circle project. Consequently, impacts to resources from the proposed action would not occur.

However, the purpose of the proposed project (Section S-1.A.1) would not be achieved. Similarly, the national goal to reduce dependence on foreign oil sources (discussed in the Site-Specific Analyses Introduction) would be harder to achieve without the 31,500 bpsd of shale oil projected for production by this project. A financial impact of unknown amount would occur to Magic Circle.

M-5.A **CUMULATIVE IMPACTS**

Cumulative impacts result when a new project is developed in an area in which other projects exist or are proposed. Although the impacts from the individual projects might be minor, the impacts from all projects in an area could be significant. The interrelated projects considered in the cumulative impact analysis for the Magic Circle Cottonwood Wash Project are listed in Tables R-1-2 and R-1-3. The projects proposed by the other applicants were not considered here, because the cumulative impacts of all the applicants' projects were discussed in Chapter R-4, Regional Environmental Consequences.

The only resources that would sustain significant cumulative impacts from the addition of the Magic Circle project to the Uintah Basin would be socioeconomics, air quality, wildlife, agriculture, and recreation.

M-5.A.1 SOCIOECONOMICS

Adding the effects of the interrelated projects and the effects of the Magic Circle project, total impacts would become much greater. Uintah County would remain the most affected county. The Colorado area would still be minimally affected with a population increase in 1988 of 3.6 percent over baseline. The community of Dinosaur, however, would be significantly affected. The impacts to the Uintah and Ouray Indian Reservation would be similar in nature, although less intense than described in Section R-4.A.1, Socioeconomics, because the projected population increase would be less.

Population and Employment

Population in Uintah and Duchesne counties and the Colorado area would be expected to increase by 9,873 people in 1986 and 18,341 people in 1988. Uintah County's population growth over baseline would be 27.8 percent (7,367 persons) in 1986 and 48.2 percent (13,520 persons) in 1988. Duchesne County's increases would be 11.4 percent (2,061 persons) and 20.6 percent (3,839), respectively. On a community level, Vernal would experience most of the population growth. In 1986, the increase over baseline would be (2,617 persons) 27.1 percent; in 1988, the increase would be 46.0 percent (4,788 persons). Roosevelt's degree of impact would follow closely behind with increases of 422.9 percent in 1986 and 41.1 percent (2,452 persons) in 1988. Dinosaur would have an increase of 196 persons in 1986; however, this would be 44.5 percent above the projected baseline. In 1988, 454 persons would be added to the projected baseline, which would be a 114.6 percent above baseline.

In terms of employment, Uintah County would experience the major impacts, with a 48.6 percent (5,257 persons) increase over projected baseline in 1986 and 82.4 percent (9,316 persons) in 1988. Duchesne County's maximum employment increase would be 9.2 percent in 1988.

Housing

Uintah County would have the greatest increased housing demand, while on a community level, Vernal would experience the greatest increase. In 1986, Uintah County's increase over baseline would be 24.4 percent (1,932 households); in 1988, the percentage would be 45.2 (3,715 households). Vernal would have an increase of 26.1 percent (833 households) in 1986 and 45.9 percent (1,556 households) in 1988. Dinosaur would have 60 additional households in 1986 and 133 in 1988, but in comparison to the small baseline, this would result in percentage increases of 39.0 percent in 1986 and 95.7 percent in 1988. Roosevelt would also have significant increases. The implications of the large housing demand increases likely would be a severe short-term shortage of available housing.

Personal Income

Personal income in the impact area would increase by $188.2 million (1980 dollars) in 1986 and $329.4 million in 1988.

Government Services and Facilities

Uintah County would receive most of the education impacts. In 1986, the increase in demand for teachers and classrooms over baseline would be 17.2 percent in 1986 and 28.9 percent in 1988. Duchesne's demand growth would be 14.4 percent and 28.9 percent, respectively.

Uintah County, again would experience the major health impacts. In 1986, 12 additional hospital beds (24.5 percent increase over baseline) would be reuired. The increase in 1988 would be 27 beads (48.2 percent increase). Expansion of existing facilities would be required. In terms of personnel, there would be a demand for 4 more physicians and 13 more nurses in 1986. In 1988, this demand would increase to 10 additional physicians and 29 additional nurses over baseline.

The Duchesne-Uintah County mental health service area would have a demand for 2 additional social workers in 1986. In 1988, there would be a demand for 3 additional social workers and 1 additional psychiatrist over baseline demands.

In 1986, there would be a demand for 7 additional police officers and 2 additional patrol cars in Uintah County. Duchesne County's increase in demand would be 1 additional officer in 1988.

The community of Vernal would have the greatest increase in sewer demand. In 1986, increase over baseline would be 27.1 percent; while in 1988, it would be 46.0 percent. Vernal would have to expand its present facilities to meet these demands. If its planned sewage system expansion is completed on schedule, adequate capacity will exist. Roosevelt's existing capacity could handle the projected demands for that community.

Vernal would incur the greatest water supply system impact, having a demand for 769 additional connections in 1986 and 1,408 in 1988. This is a 27.0 percent and a 46.0 percent increase ober baseline, respectively. Vernal would have to construct their planned water expansion project in order to meet this demand, since the existing system is already under strain. The other affected communities have existing capacities that could handle the projected future demands.

Uintah and Ouray Indian Reservation

Adding interrelated projects to potential impacts from the Magic Circle project would increase the magnitude of impacts to the reservation. Potential impacts would be the same as those described in Section R-4.A.1, Socioeconomics. Impacts would be smaller than the cumulative effects of all projects discussed in the regional analysis.

Quality of Life

The population growth associated with this level of development would have significant local social effects. Uintah and Duchesne counties and the community of Dinosaur, Colorado would experience changes similar in nature, but at a lower order of magnitude, to those described under the regional high-level scenario (Section R-4.A.1).

M-5.A.2 AIR QUALITY

Cumulative increment consumption is compared to the PSD incremental limitations in Table M-5-1, which shows that no PSD incremental limitations would be exceeded. Cumulative maximum ground-level pollutant concentrations are compared to the NAAQS in Table M-5-2. Cumulative particulate impacts would add to the NAAQS violations expected to occur from baseline sources. No other NAAQS violations would be expected to occur.

TABLE M-5-1

COMPARISON OF PSD INCREMENTS WITH CUMULATIVE INCREMENT CONSUMPTION

PSD Increments/Increment Consumption	SO_2 Concentration (ug/m^3)[a]			TSP Concentration (ug/m^3)[b]	
	3-Hour Average	24-Hour Average	Annual Average	24-Hour Average	Annual Average
Class II Areas					
PSD Class II increment	512	91	20	37	19
Cumulative increment consumption	137	34	1	less than 34	less than 4
Cumulative increment consumption at Uintah and Ouray Indian Reservation	24	4	0	less than 35	less than 4
Class I Areas					
PSD Class I increment	25	5	2	10	5
Cumulative increment consumption at Flat Tops Wilderness Aea (federal Class I)	1	0	0	0	0
Cumulative increment consumption at Maroon Bells-Snowmass Wilderness Area (federal Class I)	0	0	0	0	0
Cumulative increment consumption at Dinosaur National Monument (Colorado Category I and potential federal Class I)	7	1	0	1	0
Cumulative increment consumption at Colorado National Monument (Colorado Category I and potential federal Class I)	0	0	0	0	0

[a] Calculated using the SAI Gaussian Puff Model with a 5-kilometer grid spacing.

[b] Class II increment calculated using EPA Complex I Model with a 1-kilometer grid spacing; Class I consumption calculated using the SAI Gaussian Puff Model with a 5-kilometer grid spacing.

TABLE M-5-2

COMPARISON OF CUMULATIVE MAXIMUM GROUND-LEVEL POLLUTANT CONCENTRATIONS WITH THE NATIONAL AMBIENT AIR QUALITY STANDARDS (NAAQS)

Pollutant/Averaging Time	Maximum Cumulative Ground-Level/Concentrations (ug/m^3)[a]	NAAQS ug/m^3
Sulfur Dioxide (SO_2)	314	1,300
3-Hour	56	365
24-Hour	1	80
Total Suspended Particulate (TSP)		
24-Hour	less than 256	150
Annual	less than 59	60
Nitrogen Dioxide (NO_2)		
Annual	7	100
Carbon Monoxide (CO)		
1-Hour	244	40,000
8-hour	244	10,000
Ozone (O_3)		
1-Hour	72	240
Hydrocarbons (HC)		
3-Hour	103	160

NOTE: It is conservatively assumed that baseline maximum, Magic Circle maximum, and interrelated projects maximum all coincide.

[a]Includes baseline, applicants facility, and interrelated projects.

M-5.A.3 WILDLIFE

The influx of new people into Uintah County due to the Magic Circle project and interrelated projects would cause direct and indirect impacts to wildlife. (Uintah County and the Uintah and Ouray Indian Reservation are the only areas where cumulative impacts to wildlife as a result of implementing the Magic Circle project and interrelated projects are expected to be significant.) Indirect impacts to wildlife caused by an estimated influx of 7,367 new people in 1986 and 13,520 new people in 1988 include, but are not limited to harassment, poaching, and wanton killing, resulting in possible wildlife population reductions. It is estimated that losses from poaching and wanton killing would increase about 27.8 percent by 1986 and by 48.2 percent by 1988 because of the increase in human population. Other indirect impacts include an estimated 27.8 percent increase in demand for the opportunity to hunt and fish by 1986. There would also be about a 27.8 percent increase in competition for limited licenses or permits by 1986, which would reduce the chances of local sportsmen obtaining these permits at the same rate they now enjoy.

M-5.A.4 AGRICULTURE

Cropland

Implementation of the proposed Magic Circle project along with the interrelated projects would cause a predicted population increase of 18,341 people in the Uintah Basin by the year 1988. This would result in conversion of an estimated 4,035 acres of cropland, including prime agricultural land, to homesites and other related urban development in the Ashley Valley, Pelican Lake, and Roosevelt areas. This is approximately 4.5 percent of the cropland in the area. This land use conversion would contribute to the loss of cropland in the region, as discussed in Section R-4.A.6, Agriculture.

M-5.A.5 RECREATION

Based on the expected cumulative construction-related population growth in the defined area of influence (Uintah and Duchesne counties, Utah; Grand, Mesa, Moffat, and Rio Blanco counties, Colorado) of 17,690 people in 1986 (peak construction year) and a cumulative operation-related population growth of 24,452 people in 1988 (peak operation year), significant cumulative impacts would likely result to hunting, water-oriented recreation, and municipal leisure-time activities.

Not only would a loss of game habitat occur due to the Magic Circle project as well as interrelated projects, but due to the population growth projections stated above, hunting success would generally diminish because of increased hunting competition for a limited resource, increased incidences of hunter contacts adversely affecting the hunting experience, and increased competition for hunting permits. Poaching and wanton killing of wildlife along the White and Green river basins and on the Uintah and Ouray Indian Reservation also likely would increase. All of these impacts would affect hunting opportunities and experiences in the Magic Circle project area, and adjacent areas.

The development of the proposed White River Dam Project would create new outdoor water-based recreation opportunities for the Magic Circle work force, especially those workers living at the on-site construction camp; assuming the reservoir project would be completed by that time.

Due to the influx of a large energy-related (Magic Circle project combined with the interrelated projects) work force expected to permanently reside in either Vernal and Roosevelt, Utah, serious deficiencies in the quality and supply of municipal leisure-time indoor facilities and activities are predicted. By 1988 (peak operation year), there would be a 46.0 percent increase over baseline projections in people expected to be permanently residing in Vernal; there would be a 41.1 percent increase in Roosevelt. Studies of energy boom towns have documented the frustration, boredom, and resulting social problems which come about when leisure-time facilities and park areas for workers and their families and/or friends are inadequate (Davenport 1979). At least one additional year-round swimming pool is currently needed in the Roosevelt area (Eschler 1982). Several new or existing facilities (community center, tennis courts, basketball facilities) in these communities would need to be developed, upgraded, or expanded to meet the predicted demand for quality municipal recreational pursuits.

CHAPTER P-1
PARAHO-UTE PROJECT
DESCRIPTION OF PROPOSED ACTION AND ALTERNATIVES

P-1.A **INTRODUCTION**

Paraho Development Corporation (Paraho) proposes to develop the Paraho-Ute Project, an oil shale facility. The project would be located on a 1,416-acre site in Uintah County, Utah. Limited operation would begin in late 1985, with full production of approximately 42,000 barrels per stream day (bpsd) anticipated for fall of 1987. Development of the project would require the issuance of rights-of-way by the Bureau of Land Management (BLM) Vernal District Office.

In addition to the 1,416-acre site, the company has initiated steps to acquire more property (resources) to extend the project life. Although not fully determined at this time, land exchanges and future acquisitions under negotiation, could increase Paraho's total holdings.

The information included in this chapter is summarized from the more detailed Paraho Technical Report (Paraho 1982). This summary focuses on impact causing aspects of the proposed project and Off-Site Construction Camp alternative. More detailed information about all aspects of the Paraho project is included in the Paraho Technical Report. Copies of this report can be obtained from Mr. Robert Heistand, Paraho Development Corporation, 300 Enterprise Building, Grand Junction, Colorado 81501. Copies are also available for review at public libraries located in the Uintah Basin, and in the Salt Lake City and Denver main public libraries.

P-1.A.1 PURPOSE AND NEED OF PROPOSED PROJECT

Purpose

The purpose of the project is to: (1) produce 42,000 bpsd of hydrotreated shale oil to be used as feedstock for refining into transportation fuels,(2) produce 185 megawatts (MW) of power of which 30 MW would be exported,(3) demonstrate that the Paraho project would be technically sound, commercially feasible, and environmentally acceptable, and(4) develop the Uintah Basin oil shale reserves in a manner to assure full resource utilization.

Need

The need for this project and other proposed synthetic fuel projects in the Uintah Basin is similar. This need is discussed in the Site-Specific Analyses Introduction of this environmental impact statement (EIS).

P-1.A.2 LOCATION

The Paraho project would be located in Uintah County, Utah, approximately 50 miles from Vernal via State Route 45 and U.S. Highway 40 (Map R-1-1 in Section R-1.A).

P-1.A.3 AUTHORIZING ACTIONS

To implement the Paraho project, certain federal, state, and local authorizing actions would have to be taken. Most of the actions that would be required to authorize the various synfuel development projects in Uintah County are similar; these are identified in the Site-Specific Analyses Introduction. The specific BLM actions that would be required for authorization of the proposed Paraho project are granting of rights-of-way for the following components:

- 3.2 miles for access roads (to Section 32 and Section 6)
- 3.5 miles for product pipeline
- 2 miles for power transmission line

Paraho has applied for the Section 32 access road and product pipeline rights-of-way.

P-1.A.4 INTERRELATIONSHIPS WITH OTHER PLANNED PROJECTS AND SPECIAL MANAGEMENT AREAS

Projects

The interrelated projects that would occur in the area of influence synfuels development are shown in Tables R-1-2 and R-1-3 in Section R-1.A.

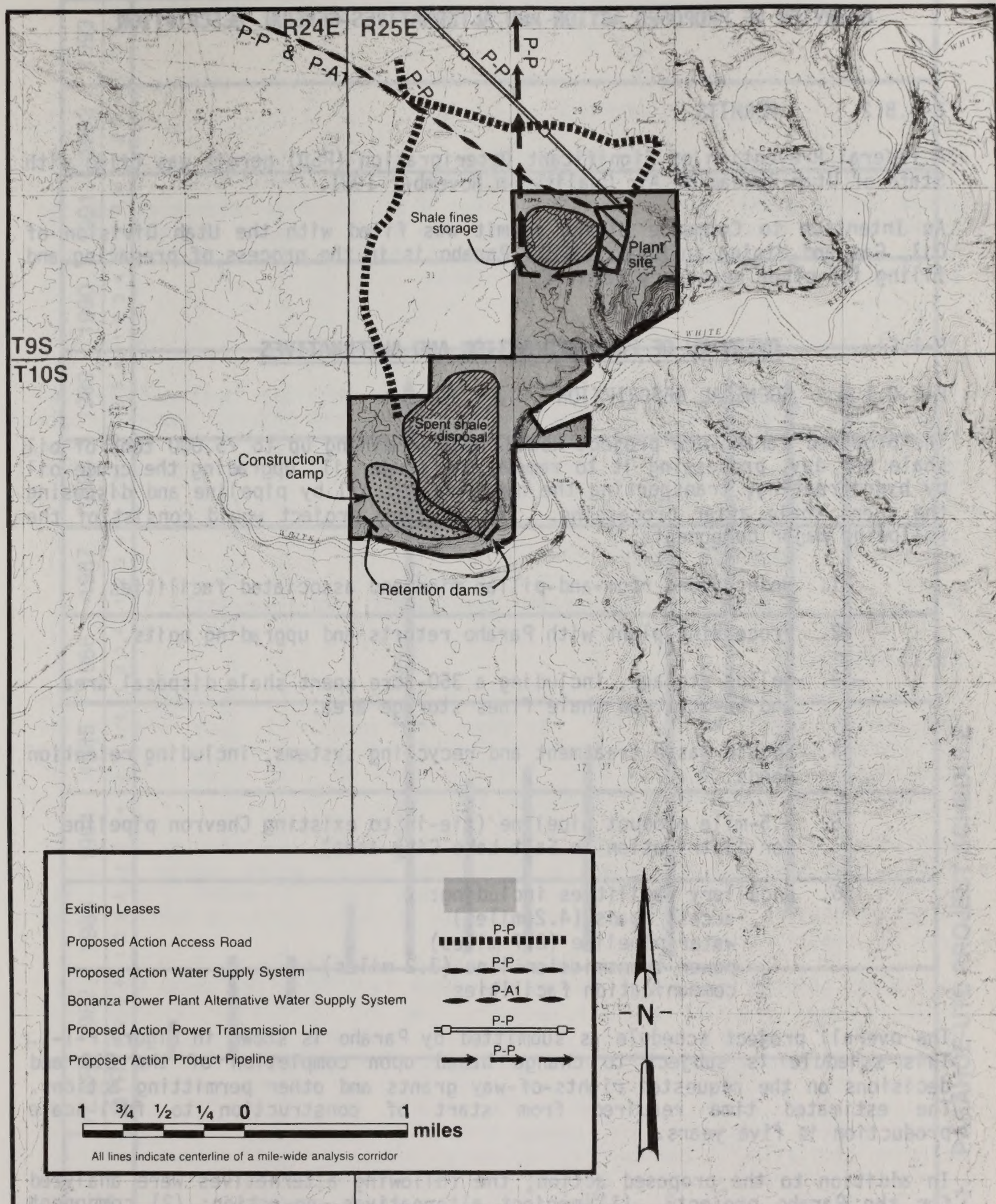
Special Management Areas

None of the proposed project components would lie within, be adjacent to, or cross any special management areas, such as a wildlife refuge or a wilderness area.

P-1.B HISTORY AND BACKGROUND

P-1.B.1 LEASES

The Paraho Development Corporation was granted a lease for 582 acres from the State of Utah in 1979 (Utah State Mineral Lease No. 35894). In addition, an adjoining 834 acres owned by Skyline Oil Company is under lease to Sohio Shale Oil Company (Sohio). Sohio will make this property available to Paraho for commercial development by sublease.



MAP P-1-1 PARAHO LEASE AREA FACILITIES

P-1.B.2 PERMITS

A federal Prevention of Significant Deterioration (PSD) permit was filed with State of Utah Bureau of Air Quality in November 1981.

An Intention to Commence Mining permit was filed with the Utah Division of Oil, Gas and Mining in March 1982. Paraho is in the process of preparing and filing for other necessary permits.

P-1.C **OVERVIEW OF PROPOSED ACTION AND ALTERNATIVES**

P-1.C.1 GENERAL DESCRIPTION

The proposed Paraho-Ute project would involve mining up to 75,000 tons of oil shale per day, processing it to remove the crude oil, upgrading the crude oil by hydrotreating, transporting the hydrotreated oil by pipeline and disposing the spent shale after processing. The proposed project would consist of the following major components:

1. Underground room-and-pillar mine and associated facilities.
2. Processing plant with Paraho retorts and upgrading units.
3. Solids storage, including a 350-acre spent shale disposal area and 66-acre raw shale fines storage area.
4. Liquid waste treatment and recycling systems, including retention ponds.
5. 3.5-mile product pipeline (tie-in to existing Chevron pipeline for distribution in Salt Lake City area).
6. Ancillary facilities including:
   - access roads (4.2 miles)
   - water pipeline (2.7 miles)
   - power transmission line (3.2 miles)
   - communication facilities

The overall project schedule as submitted by Paraho is shown in Figure P-1-1. This schedule is subject to change based upon completion of the EIS and decisions on the requested rights-of-way grants and other permitting actions. The estimated time required from start of construction to full-scale production is five years.

In addition to the proposed action, the following alternatives were analyzed for the Paraho project: (1) project alternatives--no-action; (2) component alternatives--Bonanza power plant alternative water supply system.

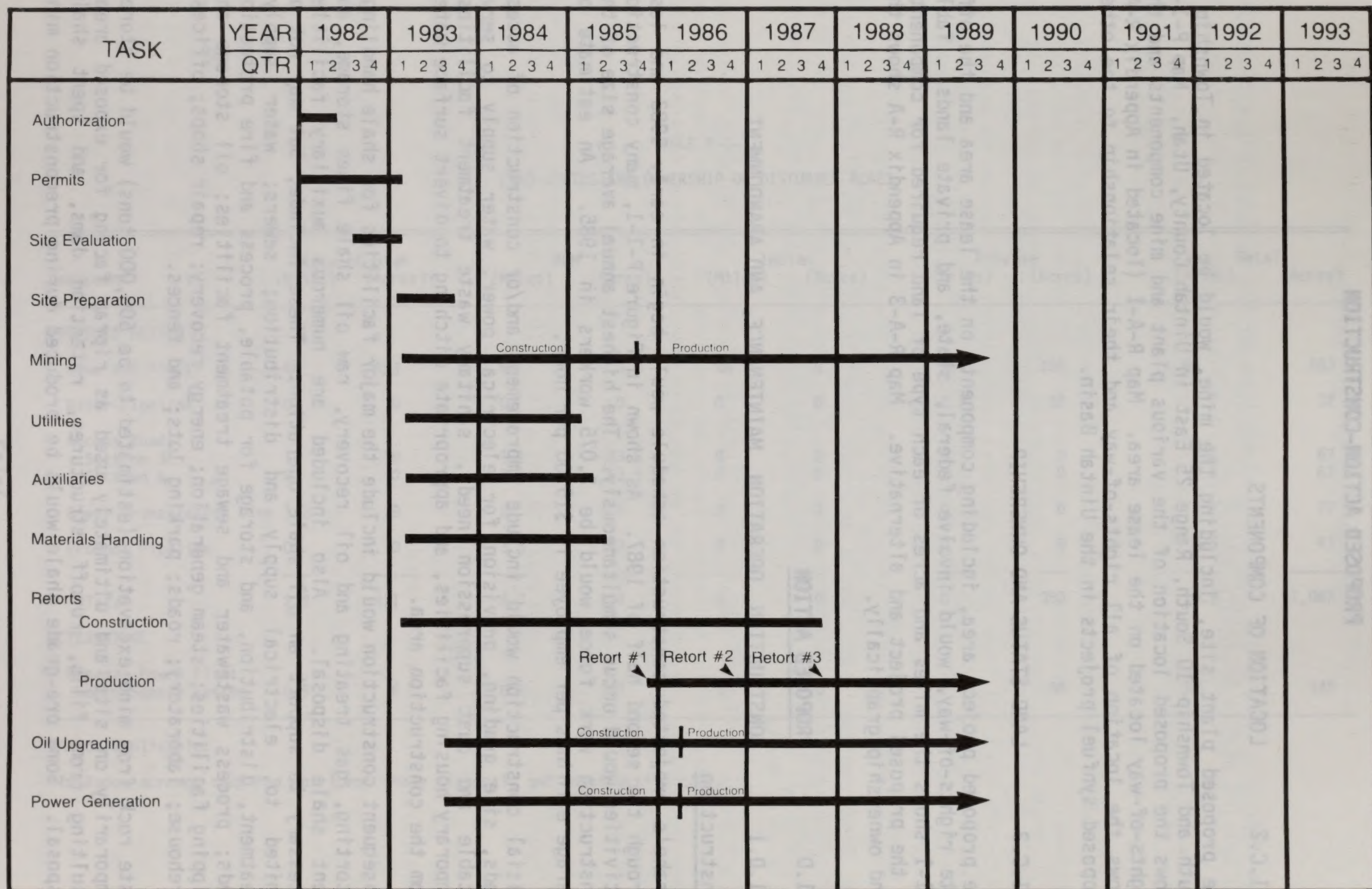


FIGURE P-1-1. PARAHOE-UTE PROJECT SCHEDULE

P-1.C.2 LOCATION OF COMPONENTS

The proposed plant site, including the mine, would be located in Township 9 South and Township 10 South, Range 25 East in Uintah County, Utah. Map P-1-1 shows the proposed location of the various plant and mine components and the rights-of-way located on the lease area. Map R-A-1 (located in Appendix R-A) shows the location of all rights-of-way and their relationship to the other proposed synfuel projects in the Uintah Basin.

P-1.C.3 LAND STATUS AND OWNERSHIP

The proposed project area, including components on the lease area and the off-site rights-of-way, would involve federal, state, and private lands. Table P-1-1 shows the miles and acres of each type of land required for components of the proposed project and alternative. Map R-A-3 in Appendix R-A shows the land ownership graphically.

P-1.D **PROPOSED ACTION**

P-1.D.1 CONSTRUCTION, OPERATION, MAINTENANCE, AND ABANDONMENT

Construction

Paraho's projected construction schedule would begin in early 1983 and last through the second half of 1987. As shown in Figure P-1-1, many construction activities would occur simultaneously. The highest annual average size of the construction work force would be 2,075 workers in 1985. An estimate of average earnings per employee is $15.00 per hour.

Initial construction would include improvement and/or construction of access roads, site grading, provision for electrical power, water supply to serve potable and dust suppression needs, sanitary waste treatment facilities, temporary housing facilities, and appropriate ditching to divert surface water from the construction area.

Subsequent construction would include the major facilities for shale handling, retorting, gas treating and oil recovery, raw oil shale fines storage, and spent shale disposal. Also included are numerous auxiliary facilities necessary to support an oil shale operation. These include, but may not be limited to, electrical supply and distribution; sewers; water supply, treatment, distribution, and storage for potable, process and fire protection needs; process wastewater and sewage treatment facilities; oil storage and shipping facilities; steam generation; energy recovery; repair shops; offices; warehouse; laboratory; roads; parking lots; and fences.

Waste rock from mine excavation (estimated to be 600,000 tons) would be stored temporarily on site and ultimately used as riprap facing for exposed areas resulting from fills, runoff structures, retention dams, and spent shale disposal. Some ore-grade shale would be produced during preconstruction mine

TABLE P-1-1

LAND STATUS AND OWNERSHIP OF DISTURBED ACRES

Component	State of Utah (Miles)	State of Utah (Acres)	BLM (Miles)	BLM (Acres)	Indian (Miles)	Indian (Acres)	Private (Miles)	Private (Acres)	Total (Miles)	Total (Acres)
PROPOSED ACTION										
Mine and Plant[a]	NA	433	NA	0.0	NA	0	NA	350	NA	863
Water Pipeline	0	0	0	0	0	0	2.7	32	2.7	32
Access Roads										
Section 32	1	30	1.1	33.5	0	0	0	0	2.1	63.5
Section 6	0	0	2.1	63.5	0	0	0	0	2.1	63.5
Power Transmission Line	1.2	8	2	14	0	0	0	0	3.2	22
Product Pipeline	0	0	3.5	43	0	0	0	0	3.5	43
Total	2.2	471	8.7	154	0	0	0	350	10.9	1,087
ALTERNATIVE										
Bonanza Power Plant Water Supply System	0.5	6	8.5	103	0	0	3	36	12	145

NA=not applicable.

[a]Includes acreage required for spent shale disposal, and construction camp.

development. This shale would be stockpiled on the surface and used during the initial phases of retort operation.

Construction of crude shale oil upgrading facilities would be completed after the first retort is on-stream. Crude shale oil produced until that time would be stored on site.

Paraho would construct temporary living quarters on site for construction personnel. It is estimated that approximately 70 percent of the construction work force would live in this construction camp. (About 10 percent of the workers may be hired locally, which would leave about 20 percent who would be new to the area and live in the regional communities.) In order to accommodate the peak work force, about 100 acres would be required for the camp. After the mine and plant construction is completed, the camp would be dismantled, and all disturbed areas would be reclaimed or prepared for future uses (such as retorted shale disposal).

The construction camp would provide individual, motel-like rooms for individual workers. Accommodations for families with children are not being considered. Provision for recreational vehicles such as trailers and campers may also be made.

A full range of food, laundry, and security services and diverse indoor and outdoor recreational facilities would be provided at the construction camp community center. Transportation to and from the construction site would also be provided.

Most of the heavy machinery, equipment, and materials to be used during construction and operation would be purchased outside the area. A majority of the heavy and/or bulky items would be shipped by rail. The nearest railheads are located approximately 120 miles south at Mack, Colorado, and 200 miles west at Salt Lake City, Utah. There is no rail service planned to the plant site at present. Supplies and equipment arriving by rail at Mack, Colorado, would be trucked through Rangely, Colorado, to the plant site. Those arriving by rail in Salt Lake City, Utah, would be trucked through Vernal, Utah, to the plant site

Supplies being shipped entirely by truck from the west would pass through Vernal, Utah, and probably Salt Lake City. Trucks from the east could follow I-70 from Denver, Colorado, to Rifle or Grand Junction, Colorado, traveling north to Rangely, Colorado, and the plant site. Trucks from the south would pass through Grand Junction, Colorado, proceeding north to Rangely, Colorado, to the plant site.

During construction, truck traffic would increase to the plant site due to delivery of supplies and equipment. It is estimated that an average of 10 to 15 trucks per day would be arriving at the plant. Truck traffic would decrease during the later stages of construction.

A mine access road constructed to the air intake entrance would be used to transport large machinery into the mine.

A river water treatment facility would be built on site during an early stage of construction. During construction, approximately 100 gallons of water per person per day would be available for potable needs. In addition, water would be available for non-potable needs such as fire protection, dust control, and concrete manufacture.

The construction of all project components would result in the disturbance of approximately 1,087 acres.

The general construction procedures that would be followed for this project are:

- Construction practices would be designed to minimize surface disturbance.

- Temporary berms and dikes would be constructed to prevent discharge of sediment-laden runoff into the White River.

- Upon completion of construction activities, all disturbed areas not required for the permanent surface facilities would be reclaimed.

  (See Appendix R-J for an explanation of reclamation procedures that would be used.)

  - All existing improvements (e.g., fences and pipelines) along project-related linear facilities (pipelines, power transmission lines) would be protected, and damage due to construction would be repaired.

  - Fugitive dust generated during construction would be suppressed as necessary to comply with air quality regulations.

  - Material borrow areas and temporarily disturbed areas would be restored by grading, contouring, transplanting, and reseeding to blend with adjacent terrain.

  - Appropriate road signs for public safety purposes would be provided during construction. Flagmen, barricades, and other safety measures would be provided to ensure public safety. Plant site traffic areas would be paved.

  - The plant would be sited and designed to minimize its visibility from outside the project area. Plant facilities on Section 32 would be set within a topographic depression about 150 to 200 feet below the surface of the surrounding area.

  - Colors selected for structures would blend with the natural landscape. This would be effective in reducing the contrast of obtrusive structures.

  - Paraho would comply with appropriate permitting authorities for transporting heavy components.

- Paraho is coordinating with all regional, county, and local officials in planning, scheduling, and implementing construction and develoment. This will aid local governments in planning for project-related community impacts.

Operation and Maintenance

After construction of the first retort is completed in late 1985, start-up operation would occur. The hydrotreater would begin operation around late spring 1986. At this time, the crude shale oil that was stored would be upgraded. The second retort would start producing crude shale oil in the summer of 1986. Full production would begin in mid-1987 when the third retort and second hydrotreater begin operation.

Mining, retorting, and product oil upgrading would occur continuously throughout the operating life of the project. Operations would occur approximately 330 days per year, with the remaining days used for scheduled maintenance. The surface facilities, tertiary crushing units, retorts, hydrotreater, Stretford gas desulfurization unit, and water treatment units would run continuously, with 21 shifts a week. The mine would produce shale 20 shifts a week, utilizing the remaining shift for maintenance of the mine and equipment. About 1,100 workers would be required to operate and maintain the mine and plant facilities at full production.

Under normal operation, up to 75,000 tpsd of oil shale would be mined. This ore would be crushed and transported via above-ground conveyors to the Paraho retorts. Raw shale fines (materials less than 3/8 inch) would be screened from the retort feedstock. These fines would be stockpiled in a 66-acre site on Section 32 adjacent to the plant operation. The retorted shale would be transported to the disposal area via above-ground conveyors.

The crude shale oil would leave the retort as a mist through oil-gas separation units. The wet crude shale oil would be transferred to day storage tanks (4 tanks, each with a capacity of 53,000 barrels). A portion of the oil-free gas would be recycled and returned to the retort. The remaining product gas, would be directed to the gas clean-up/utilization units.

In the day tanks, as much as 6,000 bpsd of water would be separated from the crude shale oil. The dry shale oil, 39,500 bpsd, would be transferred to intermediate storage and then the upgrading facility.

The crude shale oil would be upgraded to produce about 42,000 bpsd of hydrotreated oil. This oil would be distributed to markets via a tie-in to the Chevron pipeline.

Sulfur would be recovered through product gas clean-up and Stretford units. If a market is not available, about 100 tpsd of sulfur by-product would be disposed as a dry cake in the spent shale pile.

Ammonia would be recovered primarily as a by-product from gas and conversion of nitrogen compounds in crude shale oil. The ammonia would be contained in

the various sour water streams, fed to the sour water stripper unit, and recovered as liquid anhydrous ammonia. Approximately 210 tpsd of ammonia would be stored and marketed.

All facilities would be operated in compliance with appropriate regulations, including those addressing worker safety and health. Noise exposure guidelines would be followed.

Air emissions would be controlled by the imposed restrictions of the appropriate permitting agencies. The major pollutant emissions would be total suspended particulates (93 kilograms per hour (kg/hr)), sulfur oxides (171 kg/hr), nitrogen oxides (381 kg/hr), carbon monoxide (46 kg/hr), and total hydrocarbons (5 kg/hr). Sulfuric acid emissions have been estimated at levels greater than the minimum levels defined by Prevention of Significant Deterioration (PSD) regulations. The methods used to estimate air emissions, as well as the control technologies assumed to mitigate them, are given in the Paraho Technical Report (Paraho 1982). Other procedures to be incorporated during facility operation include:

- No process wastewater would be discharged.

- Nonhazardous solid wastes generated would be handled, stored, and disposed in an acceptable manner. Hazardous wastes would be transported off site to an approved hazardous waste disposal area.

- Particulate emissions from mining would be controlled by baffled settling and wet suppression.

- Particulate emissions from primary and secondary crushing and in-mine transfers would be controlled by bag houses.

- Dust generated from surface conveyors and conveyor transfer points would be controlled by covers and enclosures. Dust contained in these covers and enclosures would be controlled by the use of bag houses or wet scrubbers.

- Fugitive dust from on-site roads would be controlled by wet suppression.

- A water wash system would reduce ammonia in the product gas prior to combustion to minimize nitrogen oxides (NO_x) emissions.

- Hydrogen sulfide (H_2S) would be removed from the product gas by a Stretford unit.

- Sanitary wastewater would be treated in a portable sanitary wastewater treatment system and reused (subject to the approval of the State of Utah Department of Health).

- Sour water (containing H_2S and NH_3) would be treated in a sour water stripper unit.

- Process contaminated runoff, gas clean-up wastewater, retort wastewater, process wastewater, and blowdown streams would be appropriately treated according to end use. Water would be stored and reused or would evaporate. No wastewater would be discharged.
- All solid wastes would be disposed in an approved manner.
- Spent shale would be disposed above ground. Impervious retaining structures and liners of highly compacted, moistened, spent shale would be used to provide a material of low permeability. The system would be designed to eliminate leachate from the disposal area. Completed areas would be revegetated as outlined in Appendix R-J.
- Raw shale fines would be stockpiled above ground. Although it is anticipated that this material would be utilized for its energy potential, present plans include handling the stockpile in a manner similar to spent shale disposal.

Abandonment

Site abandonment would include the sealing of all mine shafts and removal of surface facilities. Any salvageable items would be sold at that time. Revegetation and reclamation would continue on the spent shale disposal pile, and commence on the raw shale fines, (although they may be utilized for their energy potential) and on other areas after surface facilities have been removed. Refer to the Paraho Technical Report (Paraho 1982) for specific details. The post-operation phase would take 3 to 5 years.

P-1.D.2 PROJECT COMPONENTS

The General Mining, Processing, and Upgrading Techniques section included in the Site-Specific Analyses Introduction of this EIS describes, in a general way, the mining, processing and upgrading facilities that would be used in the Paraho project. This section includes specific details about these facilities that are pertinent to the Paraho project.

Mine System

The Paraho project would use an underground room-and-pillar mine. Pillar sizes would vary from 57 by 57 feet to 85 by 85 feet. Thus, the amount of material removed from the mining zone in each panel would vary from 76 to 65 percent of the available resource. Average recovery from the mine would be approximately 60 percent of the available oil shale resource.

Raw shale reject materials would be stored on Section 32. The total storage capacity available in this storage pile is 17 million cubic yards. This storage pile would be constructed to an elevation of 5,725 feet, approximately 300 feet above the existing terrain.

A low permeability liner would be constructed for this storage identical to that for the spent shale disposal pile (described later in this chapter in Spent Shale Disposal section). A cap of liner material, covered by a cement/processed shale mixture, would be provided on the slopes of this pile to provide an impervious cover and prevent erosion.

A 55-acre collection-retention pond would be provided downslope from the raw shale reject storage pile to contain runoff from the pile. This pond would be lined and capable of containing runoff from the 100-year, 24-hour storm. Water collected in this pond, along with treated wastewater, would be used for dust control, fire control, and similar uses. A maximum of 54,000 tpsd would be transported by conveyor.

Retorting and Upgrading System

Three Paraho retorts, which would operate independently, would be used (refer to the Site-Specific Analyses Introduction of this EIS for addition information on the Paraho retorting process). The buildings housing the retorts would be about 155 feet high. Because they would use the direct heat mode, internal combustion would produce the heat for retorting and no external fuel source would be required. The overall retorting procedure would require about 66,500 tpsd of raw shale feed when operating at design capacity. During normal operation, the retorts would produce approximately 54,000 tons of retorted shale, 39,500 barrels of crude shale oil, as much as 6,000 barrels of water (separated from the oil), and about 500 million standard cubic feet of product gas.

The crude shale oil would be upgraded using a filter, a guard bed, and a hydrotreater. Within the hydrotreater, the crude shale oil would react with hydrogen in the presence of catalysts to reduce sulfur and nitrogen content. A low sulfur, low nitrogen, premium-grade refinery feedstock would result. Approximately 42,000 bpsd of this hydrotreated shale oil would be stored in two 150,000-barrel tanks which would feed the product pipeline.

Product Gas Recovery and Clean-up System

Nearly 480,000 million cubic feet per day (mmcfd) of product gas would be produced during the retorting process. However, the internal combustion would dilute the shale gas with nitrogen and carbon dioxide. This would reduce the total hydrocarbons to less than 10 percent and the high heating value to about 140 British thermal units per standard cubic feet (Btu/scf). Alternative end uses, such as chemical feedstocks and pipeline gas, would not be viable. Therefore, the product gas would be used for on-site co-generation of electrical power and steam. Before being used, the concentrations of sulfur

and nitrogen gases would be reduced from the product gas to reduce the nitrogen oxides and sulfur oxides emissions.

The gas clean-up operation would involve removal and recovery of ammonia and hydrogen sulfide. Ammonia and most of the water soluble sulfur oxides and methylmercaptan would be removed from the product gas by compression and water washing. The ammonia-free gas would be treated in Stretford units to remove hydrogen sulfide and produce approximately 100 tpsd of sulfur. The gas clean-up system would remove more than 97 percent of the sulfur from the gas streams to produce an estimated 0.22 pounds of sulfur per barrel of hydrotreated shale oil.

The product gas utilization design would consist of a gas turbine and a steam turbine. Estimated gross power output would be 185 megawatts (MW) at 13.8 kV plus 187,500 lb/hr of steam at 165 pounds per square inch (psia) for process use. It is estimated that the peak load electrical need for the Paraho-Ute facility would be about 155 MW. Thus, about 30 MW of electrical power would be available for marketing.

At capacity, 385,000 mmcfd of clean gas, representing about 2.11 billion Btu/hr, would be available as fuel for power generation. During emergency shutdowns, this gas would be flared.

Sour Water Treatment System

Sour water, which would contain ammonia, hydrogen sulfide, water-soluble sulfur dioxide, and methylmercaptans from the ammonia removal step, would be treated in a sour water stripper unit along with other sour waters from the hydrotreater and day tanks. Approximately 210 tpsd of anhydrous ammonia would be recovered. Acid gas from the stripper unit would be sent to the Stretford units for additional sulfur recovery (approximately 25 tpsd). Part of the stripped water from the stripper unit would be recycled for use in washing product gas and for use at the hydrotreater; the remainder of the stripped water would be available for further treatment and reuse.

Product Transportation

Before the hydrotreated shale oil would be distributed for marketing, a suitable pour-point depressant would be added to the hydrotreated shale oil, so that it could be easily transported through conventional pipeline systems.

A 3.5-mile spur pipeline would be constructed to connect with the Chevron pipeline, 3 miles north of the Paraho site (Map R-A-1, located in Appendix R-A). The Chevron pipeline currently transports crude oil from Rangely, Colorado to Salt Lake City, Utah. By tying into this system, the hydrotreated shale oil could be transported to various refineries in the Salt Lake City area.

The pipeline spur system would include a pump station at the Paraho site and a relief tank at the pipeline connection point. The flow rate of the Paraho pipeline spur would correspond with the present flow rate for the Chevron pipeline. The pump station located at the Paraho site would pump the shale oil through the spur to the Chevron pipeline.

Several design features and procedures would be adopted to minimize the risks of oil spills. All facilities identified as having potential for oil spills would be surrounded by berms designed to contain the amount of oil stored. Alarms would be included to warn of potential overflow in storage tanks. Routine inspections would be conducted to check for equipment leaks or potential sources of equipment failure.

Assuming a complete rupture of the pipeline at the point where driving time to the rupture would be longest (about 3 1/2 miles) and assuming 5 minutes for confirmation of rupture and pump shutdown, a maximum spill of 2,500 bbls of oil is predicted in the event of a rupture on land. There would be no danger of a river spill, as the spur pipeline would not cross any major rivers.

Spent Shale Disposal

The spent shale disposal pile would be located about 1 mile southwest of the plant facilities and would cover about 350 acres. The spent shale would be transported to the disposal area by above-ground conveyors of the same design as those used for raw ore transporting.

The disposal area would be located in the dry canyon that bisects Section 6 and would have a capacity of approximately 110 million cubic yards. Presently, this canyon has a range in elevation from 5,500 feet, at the northern edge, to 5,100 feet, at the southern edge. The disposal pile's final elevation would be approximately 5,600 feet; therefore, the depth of the pile would range from 100 feet on the north to 500 feet on the south. The elevation of the land that would be surrounding the disposal pile when completed ranges from 5,500 feet to 5,300 feet; therefore, the final height of the disposal pile would extend from 100 to 300 feet above the surrounding topography.

A low-permeability lining, would be constructed over the area to be used for shale disposal. The liner would consist of retorted shale compacted at optimum moisture to provide permeability rates of 0.1 to 1.0 foot per year. A retaining embankment surrounding the disposal area would be constructed of retorted shale, compacted to a high density without moisturizing (except for dust control). This embankment would be covered on its outer face with heavily compacted and moistened processed shale similar to that of the lining to provide a low permeability cover. Natural rock riprap (waste rock from the mine) would be used as a final cover to protect the outer slopes from erosion. The riprap would give the steep sides the approximate appearance of surrounding land surfaces. Spent shale would be disposed within this embankment with compaction occurring through the controlled routing of hauling equipment and moistening limited to dust control.

Benches would be constructed at 200- to 300-foot elevation intervals on the spent shale embankment. This would enhance slope stability by reducing the overall slope of the disposal pile embankments. Benches also would provide a means of collecting and using runoff waters or providing an area to allow for evaporation. Runoff water from portions of the disposal pile below these benches would be controlled by a series of channels and collection-evaporation ponds. These surface water collection and retention structures would prevent discharge to the White River from a 100-year, 24-hour storm. The downstream toe of the collection-evaporation pond embankment, located in the southeast corner of the disposal area, would be above the maximum water level (elevation 5,023 feet) of the White River Reservoir. The downstream toe of the disposal pile would be above the anticipated maximum water levels in that collection-evaporation pond.

As soon as a final horizontal layer would be in place, reclamation and revegetation efforts would be initiated.

The top of the spent shale pile would be revegetated after completion of project operations. This disposal pile would be continuously built up with spent shale during the operation of the retorts. As retort operations are completed, the final top of the spent shale pile would be built followed by contouring, soil placement, and revegetation. Reclamation procedures are outlined in Appendix R-J.

As the disposal pile would be built up, the outer surface and benches (bench elevations would be approximately 5,200 feet and 5,500 feet) would be reclaimed and revegetated. The outer surface would be of compacted spent shale as described for the liner, followed with a layer of large rocks forming a riprap facing. When the disposal pile reaches the bench elevations, the benches would be highly compacted to form a low-permeability layer then covered with a layer of gravel and finally surface soil.

Ancillary Facilities

Access Roads

The main facilities access road would leave the paved Bonanza-Rangely road in Section 30 and extend to the Paraho site in Section 32, Township South, Range 25 East. A construction camp access road would leave the paved Bonanza-Rangely road in Section 30 and extend to the Paraho site, Section 6, Township 10 South, Range, 25 East. (See Maps R-A-1 (located in Appendix R-A) and P-1-1.)

The main access road would be paved to reduce fugitive dust and to provide safe, all-weather transportation. A total of 127 acres would be disturbed during construction. A 100-foot final right-of-way would be required. About 51 acres would be occupied by both roads after completion of construction.

Access to the construction camp from the main construction area would be by a 2-mile road, located completely on site.

Water Supply System

Water needed for construction of the project would be obtained from the White River and trucked on site. Water needed for operation would be purchased from the State of Utah. Paraho has a letter of intent from the state to sell up to 5,000 acre-feet of White River water per year. This water would originate from the White River Reservoir and be pumped to Bonanza. Paraho would transport the water from Bonanza to the plant site via a 2.7 mile pipeline. The pipeline would be constructed by the company solely on private land across existing gilsonite claims.

Water would be piped from the White River to the raw water treatment facility for processing. The river water would initially be subjected to clarification. Some of the clarified water would be used directly for dust suppression and retorted shale cementation. Most of the clarified water would be treated further for general plant needs and potable water supply.

After filtration, a portion of the treated water would be disinfected for potable water use, and the remainder would go to boiler feed treatment. The boiler feed treatment section would consist of caustic soda addition, ion exchange, and acidification. No antioxidants containing heavy metals would be added to boiler feed water or cooling tower water. This would simplify wastewater treatment.

Water produced through shale retorting and gas cleaning (621 acre-feet/year) would be available for reuse. This water would go to the wastewater treatment facility for clarification, treatment, and reuse.

A on-site lined collection pond would be provided in accordance with the overall drainage characteristics of the area. Total capacity of the pond would be approximately 55 acre-feet. The maximum runoff quantity from a 100-year, 24-hour storm from the raw shale fines storage area is estimated to be 11 acre-feet.

All wastewater at the plant site would be recycled for consumption or would evaporate. There would be no process water discharged from the site.

Power Supply System

A 138-kV power transmission line would link the Paraho site to the Bonanza Power Plant system. Assuming a 50-foot radius around each pole and a 20-foot wide right-of-way for the temporary road, an estimated 22 acres would be required for construction.

Wastewater Treatment System

Wastewaters from various sources would be collected in an on-site equalization pond. From there, the combined wastewaters would enter a multi-stage system consisting of oxygenators, fluidized bed bioreactors, biomass separation, gravity thickening, and aerobic digestion. Water from the wastewater

treatment would be stored in a collection pond for reuse. Two separate portable treatment systems would be used to treat the sanitary wastewater from the mine and surface facilities.

Solid Waste Disposal System

Solid wastes would be handled on a case-by-case basis. The 21 tons of wastewater treatment sludge produced daily would be stabilized in two aerobic digestor basins. The resulting stabilized sludge, along with the sanitary sludge, would be applied to the spent shale. Pretreatment lime sludge, estimated to be 108 tpsd, would contain 90 percent water and would be applied directly to the spent shale as a wetting or cementation agent.

An estimated 65 tpsd of oil filter particles would be obtained after hydrotreatment. Since this material is estimated to contain about 40 percent crude shale oil, it could be sent to a waste oil recovery processor. About 100 bpsd could be recovered from this source.

If possible, sulfur would be marketed; however, the sulfur produced by the Stretford unit may be unmarketable and therefore require disposal as a solid waste. If necessary, the dry cake sulfur, estimated to be 100 tpsd, would be disposed with the spent shale.

Hazardous Waste Disposal System

All wastes determined to be hazardous or toxic would be transported and disposed of in approved off-site locations (to be determined) using the services of an approved operator. All necessary precautions would be taken during the handling and transportation of hazardous wastes.

Spent catalysts would be handled in a variety of ways. Those that could be recovered would be handled by operators specializing in reclamation and regeneration. Those that contain oily solids may be sent for waste oil recovery. Those classified as hazardous or toxic wastes would be handled in an approved manner and transported to an approved off-site disposal facility, as discussed previously.

Communication System

To meet communication needs, a microwave system using existing stations and relays would be used for the project. Therefore, no additional lines, towers, nor rights-of-way would be needed.

P-1.E **ALTERNATIVES**

P-1.E.1 BONANZA POWER PLANT ALTERNATIVE WATER SUPPLY SYSTEM

Under this alternative, water from the Green River would be used for construction and operation of the project. This water (up to 6 cfs) would be purchased from the Bonanza Power Plant and transported to the plant site via a 12-mile pipeline (Map R-A-1, located in Appendix R-A). Approximately 145 acres would be disturbed during its construction. Water would be truck from the power plant to the plant site until construction of the pipeline is complete. All other aspects of this alternative water supply system would be the same as described for the proposed project.

P-1.E.2 NO-ACTION ALTERNATIVE

The No-Action Alternative would involve the denial of the requested rights-of way across federal land for the access road, product pipeline, and power transmission line (refer to the No-Action Alternative section of the Site-specific Analyses Introduction of this EIS for additional explanation of the purpose of this alternative).

Paraho could develop its 42,000 bpsd facility if these rights-of-way were denied, provided the potential land exchange north of the Paraho project between BLM and the State of Utah (described as part of the Syntana-Utah proposed action, Section S-1.B.1, Leases) were approved and implemented. Paraho could then apply to the State of Utah for road, product pipeline, and power transmission line rights-of-way due north instead of along the currently proposed alignments.

Table P-1-2 provides the data for the rights-of-way under this possible development scenario. All aspects of the plant and processing facility would remain the same as the proposed action.

P-1.E.3 ALTERNATIVES CONSIDERED BUT ELIMINATED FROM DETAILED ANLAYSIS

Retorting Alternatives

Two alternative modes of retorting were considered for the Paraho retorts, an indirect heated mode and a combination mode. In the indirect heated mode, the combustion zone of the direct heated Paraho process would be replaced by a shale heating zone. The shale would be heated by injection of externally heated retort gas into the bed at two levels. In the combination mode, the indirect heated mode would be combined with a retorted shale burning zone. A zone separator in the retort prevents the mingling of rich shale gas with the products of combustion.

From an environmental impact standpoint, the only resource that would be affected by either of these alternatives would be air quality. The air emissions from these processes would not be significantly different from those

TABLE P-1-2

NO-ACTION ALTERNATIVE RIGHTS-OF-WAY

Type	Length	Disturbed Acres	Reclaimed Acres	Removed Acres
Access Road	2 miles	63	39	24
Power Transmission Line	3.2 miles	22	22	0
Product Pipeline	3.5 miles	42	42	0
TOTAL		127	103	24

analyzed for the proposed direct heated mode in Section P-4.A.2, Air Quality. Therefore, these alternatives were eliminated from detailed analysis.

Upgrading Alternatives

Three upgrading alternatives were considered but eliminated from further study--hydrocracking, delayed coking, and no upgrading. Hydrocracking would produce a premium syncrude having essentially no nitrogen, no heavy ends, and having a low pour point. The upgrading unit would be costly to construct and operate and would require large amounts of hydrogen (natural gas) and water. Delayed coking would produce a premium syncrude, but it would also produce coke. Since half the synfuels effort in our nation is focused on producing liquid fuels from solids, it is not Paraho's objective to produce coke from shale oil. No upgrading would reduce the plant's water needs by about one-third, eliminate the need for natural gas, and reduce the overall capital investment. However, the resulting shale oil would have limited marketing flexibility, since crude shale oil can only be processed in large refineries which have hydrotreating cababilities.

Product Distribution Alternatives

A new product pipeline to be built directly between the Paraho site and the Plateau refinery in Roosevelt, Utah, was considered as an alternative for product distribution. Another alternative would be to truck all the shale oil to the Roosevelt refinery. Both were eliminated from detailed analysis, because they would be more costly than the proposed action and would offer no apparent environmental or project-related advantages.

Alternative Spent Shale Disposal Area

An alternative spent shale disposal area adjacent to the Paraho lease area on BLM land in Section 31 was considered but eliminated from detailed analysis, because it would create more environmental problems than the proposed action site. Because the terrain on Section 31 is relatively flat, a larger area would be required for the disposal area. This would result in a greater surface area being exposed to wind, which would cause more air quality degradation. Although the site would be further from the White River, it is part of the same drainage area, so the potential for leachate or runoff reaching the river would be the same. Use of the area for spent shale disposal could preclude development of the oil shale which underlays the section. In addition, since Department of the Interior regulations do not currently permit leasing or granting rights-of-way for spent shale disposal, a regulatory change would be necessary before this alternative could be implemented.

P-1.F **DATA SUMMARY**

Various aspects of the proposed Paraho project and alternatives (where applicable) are summarized in Table P-1-3, Magnitude and Duration of Land Disturbance; Table P-1-4, Personnel Requirements; Table P-1-5, Resources Consumed and Produced During Operation; Table P-1-6, Total Controlled Emissions; Table P-1-7, Solid Waste Generated During Operation.

TABLE P-1-3

MAGNITUDE AND DURATION OF LAND DISTURBANCE

Component	Length (Miles)	Construction Width/Size	Operation Width/Size	Maximum Disturbed Acres/Duration[a]	Removed Acres/Duration	Reclaimed Acres
PROPOSED ACTION						
Mine and Plant[b]	NA	NA	NA	433/2 years	292/10 years	141
Spent Shale Diposal Area	NA	NA	NA	350/10 years[c]	0	350
Access Roads	4.2	250 ft	100 ft	127/	10 years	76
Product Pipeline	3.5	100 ft	20 ft	43/1 year	0	43
Power Transmission Line	3.2	20 ft 50 ft radius/pole	20 ft	22/1 year	0	22
Water System	2.7	100 ft	20 ft	32/1 year	0	32
Construction Camp	NA	NA	NA	80/3 years	80/3 years	80
Communication Systems	No Acreage Required (Microwave System)					
TOTAL				1,087	343	744
ALTERNATIVE						
Bonanza Power Plant Water Supply System	12	100 ft	20 ft	145/1 year	0	145

[a]Maximum disturbed duration equals maximum duration and/or active land use.

[b]Includes on-site water pipeline and 2-mile long construction camp road.

[c]Forty acres disturbed per year.

TABLE P-1-4

PERSONNEL REQUIREMENTS

Year	Construction Work Force[a]	Operation Work Force[a]	Total Work Force[a]
1982	110	0	110
1983	925	0	925
1984	1,430	0	1,430
1985	2,075	725	2,800
1986	1,355	960	2,315
1987	500	1,100	1,700
****	0	1,100	1,100

NOTE: These are current best estimate figures, which may vary somewhat when final engineering designs are completed.

[a]Yearly average employment figures.

****Estimates for annual operation during the remaining years of project life

TABLE P-1-5

RESOURCES CONSUMED AND PRODUCED DURING OPERATION[a]

RESOURCE CONSUMPTION		RESOURCE PRODUCTION	
Resource	Quantity	Resource	Quantity
Oil Shale	75,000 tons/day	Shale Oil	42,000 barrels/day
Water[b]	2,900 ac-ft/yr	Power[c]	30 megawatts/day
Natural Gas	29,000 million cubic feet/day	Ammonia	210 tons/day
Fuel Oil	3,300 gallons/day	Sulfur	100 tons/day
Propane[d]	260 gallons/day		
Diesel	17,000 gallons/day		
Gasoline	3,000 gallons/day		

[a]Full production rates of 42,000 bpsd of hydrotreated shale oil.

[b]Water source: White River.

[c]155 megawatts/day producted; 30 megawatts/day available for export.

[d]Propane consumption would increase in the event of a natural gas shortage.

TABLE P-1-6

TOTAL CONTROLLED EMISSIONS
(Peak Operation)

Pollutant	Emission Rate (kilograms per hour)
Total Suspended Particulates	93
Sulfur Oxides	177
Nitrogen Oxides	381
Carbon Monoxide	46
Hydrocarbons	5

TABLE P-1-7

SOLID WASTE GENERATED DURING OPERATION

Product	Quantity Per Day
Wastewater Treatment Sludge	21 tons
Garbage And Scrap	5 tons
Spent Catalysts	3 cubic yards
Pretreatment Lime Sludge	108 tons (10% solids)
Oil Filter Particles	43 tons (60% solids)
Sulfur[a]	100 tons (maximum)

[a]Only a waste if not marketed.

COMPARATIVE ANALYSIS OF PROPOSED ACTION AND ALTERNATIVES

The Paraho-Ute Project proposed action, Bonanza Power Plant Alternative Water Supply System, and the No-Action Alternative are compared in this chapter. Table P-2-1 provides a comparative analysis of significant unavoidable and quantifiable impacts of the proposed action and the alternatives that would result if the Paraho project is implemented. Unavoidable adverse impacts listed in the table are negative environmental impacts that would remain despite mitigation efforts. Adverse impacts that are of low significance or of very short duration are not included.

TABLE P-2-1

SUMMARY COMPARISON OF IMPACTS BETWEEN PROPOSED ACTION AND ALTERNATIVES

Environmental Element*	Proposed Action	Bonanza Power Plant Alternative Water Supply System	No-Action Alternative***
Water Resources	2,900 ac-ft/yr depletion in the White River and Green River downstream	2,900 ac-ft/yr less flow in Green River (0.06% of average annual flow)	**
Vegetation, Soils, and Reclamation	1,087 acres disturbed	113 ac more disturbed	65 ac less disturbed
Wildlife	1,087 acres disturbed	113 ac more disturbed habitat	65 ac less disturbed habitat
Agriculture	76 AUMs of grazing lost on rangeland	8 AUMs less grazing	4 AUMs more grazing
Land Use Plans	1 mi of transmission line outside of BLM proposed planning corridor	7 mi more outside BLM proposed planning corridor	1 mi less outside BLM proposed planning corridor

NOTE: Figures are the projected change to baseline due to development of the Paraho project.

When "more" or "less" appears in the description of alternative impacts, impacts are being compared to comparable components or processes of the proposed action.

ac = acres; AUMs = animal unit months; mi = miles;

*Only those elements that have impacts that vary significantly from the proposed action are shown.

**Where no entry is made for an alternative, impact would not vary significantly from that of the proposed action.

***Assumes Paraho would obtain right-of-way from the state subsequent to potential BLM-State land exchange.

The affected environment for the Paraho-Ute Project is that part of the existing environment that would be affected by the proposed action (including all project components identified in Chapter P-1) or alternatives. The effects of the project components and the construction and operation work forces on the environment were analyzed for the same resources identified for the regional analysis (refer to the Chapter R-3, Introduction). This chapter provides information only about the environment that would be significantly affected by the Paraho project as determined by the impact analyses presented in Chapter P-4. Analysis indicated that no Wilderness Areas or any areas under formal wilderness review, study or appeal would be directly or indirectly affected by the Paraho project. Therefore, descriptions of the wilderness resource was not included.

P-3.A PROPOSED ACTION

P-3.A.1 SOCIOECONOMICS

The majority of socioeconomic impacts resulting from the Paraho project would occur in Uintah and Duchesne counties. Much less impact would be expected in the Colorado area and the Uintah and Ouray Indian Reservation. A description of the baseline present and future environment for these counties, communities, and the Colorado area that would be affected and the Uintah and Ouray Indian Reservation can be found in Section R-3.A.1, Socioeconomics.

P-3.A.2 AIR QUALITY

The Paraho plant site would be located just north of the confluence of Evacuation Creek and the White River at about 5,400 feet mean sea level (MSL). Drainage flows in the area are from the east, while prevailing winds are westerly. Baseline pollutant concentrations are compared to the National Ambient Air Quality Standards (NAAQS) in Table P-4-2 (Section P-4.A.2), which shows that (except for total suspended particulates) no NAAQS violations are expected. The baseline particulates levels are predicted to violate the 24-hour average particulate standard, mostly due to dust from dirt roads and soil particles suspended during windy conditions. Visibility measurements taken at Dinosaur National Monument are presented in Section R-3.A.2, Air Quality.

P-3.A.3 WATER RESOURCES

A description of the surface water, floodplains, and ground water that would be affected by the Paraho project is included in Section R-3.A.3, Water Resources.

P-3.A.4 VEGETATION, SOILS, AND RECLAMATION

The Paraho project would be located in an area of steep slopes along the White River where there is a greater percentage of bare areas than vegetated areas. Thirty percent of the project area is characterized by this bad land type (VTN 1981). Where vegetation occurs, it is primarily the mixed-desert shrub type. Refer to Section R-3.A.4, Vegetation and Soils, for a description and listing of species composition and communities.

No threatened or endangered species are known to be located in the project area, although a recognized species of importance, Penstemon albafluvis, has been located downstream on the White River.

Soils

Soils within the project area are forming in a setting with an average annual precipitation of 5 to 10 inches and an average frost-free season of 110 to 125 days. The soils are extremely variable and have a low potential for reclamation due mainly to shallow depth, salinity, alkalinity, slope, and climatic conditions. The dominant soils are shallow to moderately deep upland soils with low inherent fertility, moderate to strong alkalinity and contain varying amounts of rock fragments. They occur on strongly sloping convex aidges and hills and steep to very steep sideslopes bordering intermittent drainageways and the White River. Rock outcrops and exposures of geologic formations are common in the steeper sloping areas bordering the White River. Detailed soil surveys have been made of the project area (Paraho 1980; SCS and BLM 1981).

P-3.A.5 WILDLIFE

Habitat Types

The primary wildlife habitat type occurring on the project area and along the various rights-of-way is the mixed-desert shrub type. There is also a small amount of riparian habitat in the vicinity of the project area. (See Section R-3.A.4, Vegetation and Soils, for description of plant communities and species composition.) Riparian habitats in the arid and semiarid localities found in this region are unique and very important reservoirs for plant and animal diversity. In the Mountain West, approximately one-half of all bird species and nearly one-third of all mammal species are supported by this habitat type (Thomas et al. 1978).

Terrestrial Wildlife

The entire lease area (1,416 acres) is classified by the Utah Division of Wildlife Resources as high priority deer range used primarily in the winter, while the riparian zone along the White River is classified as critical summer range for mule deer (UDWR 1981).

The pronghorn antelope habitat on the lease area and various rights-of-way is classified as high priority value pronghorn antelope range on a year-long basis (UDWR 1981).

The only game bird of any consequence found on or near the project area is the mourning dove. The chukar partridge was introduced into the general area many years ago, but is apparently extinct. The Utah Division of Wildlife Resources plans to reintroduce this game bird into favorable habitat in the area within the near future. Some waterfowl habitat used, mostly for resting, is found on the White River near the southern boundary of the project area.

Raptors common to the project area include red-tailed hawks, golden eagles, prairie falcons, marsh hawks, and American kestrels. The shallow, sage-covered draws in this area furnish habitat for ground-nesting raptors, while the riparian zone along the White River furnishes many tree nesting sites for other species of raptorial birds, including great horned owls. The entire area, however, is considered to be hunting habitat for all species of raptors. There is at least one active golden eagle eyrie within 1 mile of the project site.

The species of nongame mammals, nongame birds, and reptiles and amphibians that could be found on the project area are similar to those found throughout the Uintah Basin. Refer to Section R-3.A.5, Wildlife, for a discussion of these species.

Threatened or Endangered Species

The U.S. Fish and Wildlife Service indicates that several federally listed species could occur on the project area (Table R-3-11 and Appendix R-K). Three endangered fish species have been found in the White River--the Colorado squawfish (Ptychocheilus lucius), the humpback chub (Gila cypha), and the bonytail chub (Gila elegans).

P-3.A.6 AGRICULTURE

Cropland

There is no cropland located within or immediately adjacent to the Paraho project area or within any of the facility corridors of the proposed action. Cropland, including prime agricultural land in the Ashley-Jensen and Rangely areas, would be affected by land use conversion for homesites and related urban development to accommodate the increased population due to the Paraho

project. For a description of cropland that would be affected, refer to Section R-3.A.6, Agriculture.

Grazing

The project would be confined to one grazing allotment and one livestock operation. The allotment grazing capacity is 3,745 animal unit months (AUMs) on 42,404 acres of public, private, and state lands over a 5-month grazing season from November to March. State and private land are administered by the BLM under an exchange-of-use agreement.

P-3.A.7 TRANSPORTATION NETWORKS

The transportation networks that would be affected by the Paraho project are described in Section R-3.A.7, Transportation Networks.

P-3.A.8 RECREATION

Approximately 3 miles of the White River would cross or be adjacent to the proposed project area. Although there are no known river-running statistics available for this segment of the White River, it is estimated that fewer than 20 to 70 parties per year run the river (NPS 1982) during late spring and early summer when the river flows are high. A favorite launch site for many of these river trips is in Cowboy Canyon. Recreation values enjoyed in the project area by river rafters and canoeists include rugged canyon scenery, relative abundance of wildlife, and a feeling of remoteness. The White River possesses values that have been identified as being nationally significant and may be eligible for study and possible inclusion into the National Wild and Scenic Rivers System (HCRS 1981) as described in Section R-3.A.8, Recreation. However, since in this EIS analysis it is assumed that the White River Dam would be constructed, the recreation values which may be affected by the Paraho project would be related to the new reservoir rather than the existing river.

Some off-road vehicle (ORV) use for sightseeing pleasure, river access, deer hunting, and dispersed camping occurs on the proposed project area.

The municipal and county recreation facilities that may be affected by the employees of this project are described in Section R-3.A.8, Recreation.

P-3.A.9 CULTURAL RESOURCES

Prehistory

The Paraho project area lies within the Uintah Basin of the Colorado Plateau as described in Section R-3.A.10, Cultural Resources. Portions of the Paraho project have been surveyed for cultural resources. The mine lease tract and approximately 7 miles of access road and utility corridor were surveyed by

Nickens and Associates (Tucker 1980). No prehistoric or historic sites were identified by them in these areas. The survey report concluded that the Paraho project area was rarely used by prehistoric peoples. This conclusion is supported by other work in the area that correlates a low site density with desert shrub vegetation (Jones and MacKay 1980; Larralde and Chandler 1981). No prehistoric sites were found along the White River in the Paraho lease area. This was contrary to expectations, as Berry and Berry (1976) found a high correlation of high site density along the river. The amount of land along the White River in the Paraho lease area is too small to explain this anomaly (Tucker 1980).

History

The general history of the area is included in Section R-3.A.10, Cultural Resources. No historic sites were located on the Paraho project area during the survey by Nickens and Associates. A glass bottle and metal containers were located within the proposed utility corridor. These artifacts were recorded as isolated finds instead of sites. The artifacts were probably associated with gilsonite exploration or sheepherding activities during the 1920's. None of the artifacts remaining in the project area are considered significant. (Tucker 1980)

P-3.A.10 VISUAL RESOURCES

The proposed project would be developed within the Colorado Plateau physiographic province. Local conditions may be summarized by describing the landform as mostly a desert plateau with low rolling hills and occasional deep drainage patterns, segmented by the White River. Vegetation consists of mixed-desert shrub with interspersed riparian zones. The area is generally uninhabited, but contains a high degree of cultural modification through the presence of oil and gas and gilsonite activities and numerous roads.

The project area consists of two VRM classes. Class II extends along the White River for approximately 1 mile on either side of the river. The remainder of the project area is categorized as VRM Class IV (BLM 1979a). Refer to Appendix R-H, Visual Resource Management Methodologies, for an explanation of VRM classes.

The project would affect the existing visual environment in only a limited number of areas, since the area is generally unseen from highly sensitive areas, except along the White River and the county road which crosses the area. Approximately 103 acres of VRM Class II areas would be affected and 24 acres of VRM Class IV areas would be affected by the proposed action. Refer to Section R-4.A.11, Visual Resources, for an explanation of the methodology used to determine areas in which the visual resources would be affected.

Existing visibility conditions are discussed in Section P-4.A.2, Air Quality.

P-3.A.11 PALEONTOLOGY

Notable finds of leaf fossils have been identified in the vicinity of the Paraho lease area.

P-3.A.12 MINERAL AND ENERGY RESOURCES

The mineral and energy resources underlying the 1,416-acre lease area are similar to those found throughout the Uintah Basin. These resources are identified in Section R-3.A.13, Mineral and Energy Resources.

P-3.A.13 EXISTING LAND USE PLANS

The land use constraints for the Paraho project are summarized in Section R-3.A.14, Existing Land Use Plans.

P-3.B **ALTERNATIVES**

With the exception of the points discussed below, the affected environment for all the alternatives to the proposed Paraho project would be similar to that described for the proposed project (Section P-3.A). The acres of land that would be affected by each alternative are listed in Table P-1-2, Section P-1.F. The Bonanza Power Plant Alternative Water Supply System would cross two grazing allotments that are used for winter grazing of sheep. The pipeline route for this alternative has not been surveyed for cultural resources.

Environmental consequences are those impacts resulting from implementing the proposed action or the alternative. In this chapter, impacts are discussed in a level of detail that corresponds to the severity of impact. Thus, the most significant impacts are discussed in the most detail. No Wilderness Areas or any areas under formal wilderness review, study, or appeal would be significantly affected by the proposed action or alternatives and, therefore, wilderness resources are not discussed further.

P-4.A **PROPOSED ACTION**

P-4.A.1 SOCIOECONOMICS

Population and Employment

The Paraho project would employ 2,800 people during the peak construction year (1985). Total employment would decrease to 1,650 for the peak operating year (1987). Total population increase for Duchesene and Uintah Counties and the Colroado area would be 5,117 persons in 1985 and 4,239 in 1987. Uintah County would be expected to have approximately 80 percent of the population growth and over 90 percent of the employment increases for both peak years. (Though the Paraho project would be very close to the Colorado area, it was assumed that the poor conditions of the road between Bonanza and the Colorado state line and Uintah County's non-maintenance policy for this road would preclude commuter travel on the road. Thus, it was assumed that the travelway to Rangely was the Bonanza road to SR 40 to SR 64. This, in turn, reduced the population allocations to the Colorado area. (Barber 1982)) Duchesne County and the Colorado area would have minimal impacts. In 1985 Uintah County's population increase over baseline would be 16.4 percent (4,218 persons) This would decrease to 12.2 percent in 1987 (3,337 persons).

The incorporated community of Vernal would experience the majority of population increase from the Paraho project. Roosevelt would have impacts but to a much lesser extent. Myton and Ballard would not be expected to have measurable increases. Rangely would have minimal population increases; however, Dinosaur would have substantial increases compared to baseline. Vernal would have population increases over baseline of 13.9 percent (1,289 persons) in 1985 and 14.5 percent (1,465 persons) in 1987. Dinosaur's increases would be 23.5 percent (118 persons) over baseline in 1985 and 29.2 percent (127 persons) in 1987.

Employment increases would center in Uintah County, which would have an increase over baseline of 30.5 percent (3,226 persons) in 1985 and 19.3 percent (2,138 persons) in 1987. Duchesne County's increase would be relatively small.

Housing

Housing demands would be substantial in Uintah County during both peak construction and operating years. In 1985, housing demand would exceed baseline demand by 10.7 percent (822 households). For 1987, the demand increase would be 11.7 percent (944 households). Duchesne County would have a maximum increase in demand of 3.7 percent in 1985. At the community level, Vernal would have the most severe housing demand increase. Impacts would peak in 1987, increasing baseline demand by 13.9 percent (403 households). Dinosaur's demand increase would be 11.2 percent (37 households) in 1985 and 24.4 percent (40 households) in 1987. such large increase in housing demand would result in significant short-term housing shortages. Temporary housing units, such as trailer parks, would likely result. Also, because of the shortage, the problem of unauthorized settlement on public and private lands would increase.

Personal Income

Personal income increase resulting from the Paraho project would be $104.3 million (1980 dollars) in 1985 and $66.1 million in 1987.

Government Services and Facilities

Uintah County would be the only county having significant population increases.

In 1985, there would be a demand for 22 more teachers and classrooms over the projected baseline demand for the county. In 1987, the demand would remain about the same, with 23 more teachers and classrooms needed over the baseline.

Uintah County would be most affected in terms of health services. Health demands would peak in 1987, with 6 more hospital beds (10.9 percent increase over baseline) being in demand. In 1987, 6 more nurses would be in demand.

Minimal impacts to mental health services would occur in the analysis area. Only 1 additional social worker would be required.

Uintah County would be the only area requiring measurable expansion in law enforcement services. In 1985, there would be a demand for 3 additional police officers (9.6 percent increase over baseline). The same number of officers would be in demand in 1987. Vernal would require much more expansion in law enforcement services. There would be a demand for 22 additional officers over baseline as a result of the Paraho project in 1985. In 1987, the number would be slightly higher at 27 officers.

Most of the sewer service impacts would be centered in Vernal. In 1985, increased sewer demand would be 13.9 percent above baseline; while in 1987, it would be 14.5 percent. The increased demand could be handled if the proposed sewer expansion project is constructed on schedule.

Water impacts would also be concentrated in Vernal. The increase in water connections over baseline would be 13.9 percent in 1985 and 14.6 percent in 1987. If Vernal expands its system as planned, the additional demand could be handled.

Quality of Life

The local social effects projected to occur if this project is implemented would be centered in Uintah County, with low-level effects expected in the Roosevelt area as well. The changes in Uintah County would be similar to those described under High-level Scenario (Section R-4.A.1) but at a much lesser scale and intensity.

Uintah and Ouray Indian Reservation

The Paraho-Ute project would be located about 75 miles (by road) from the reservation boundary. No facilities are proposed to cross the reservation. However, the Ute Tribe would still experience a minor amount of primary and secondary effects similar to those discussed in Section R-4.A-1, Socioeconomics. The magnitude of these impacts would be less, however.

P-4.A.2 AIR QUALITY

Estimated increased total suspended particulate and sulfur dioxide concentrations are compared to the prevention of significant deterioration (PSD) incremental limitations in Tables P-4-1 and P-4-2. Increased sulfur dioxide and particulates concentrations would be within the PSD increments. The 24-hour total suspended particulate concentration is predicted to violate the National Ambient Air Quality Standards (NAAQS) mainly due to baseline sources, mostly dirt roads and wind-raised soil particles rather than emissions from Paraho. Particulate emissions from Paraho would exacerbate the high total suspended particulate levels. All other NAAQS would be met.

The Air Quality Technical Report (Systems Applications Inc. 1982) contains isopleths for increased 3-hour, 24-hour, and annual sulfur dioxide concentrations and 24-hour and annual total suspended particulate concentrations.

The potential for atmospheric discoloration at Dinosaur National Monument and the Uintah and Ouray Indian Reservation were calculated. The results predicted that a faintly visible yellow-brown atmospheric discoloration resulting from Paraho emissions of nitrogen oxides would be observed at the Dinosaur Visitors Center from 0 to 25 morning per year and 0 to 9 afternoons per year, depending on the sensitivity of the observer. A faintly visible yellow-brown discoloration would be visible an estimated 0 to 22 mornings and 0 to 5 afternoons per year at the Uintah and Ouray Indian Reservation. The discoloration could also be visible in the vicinity of the facility during some conditions, especially clear, stable mornings with light winds.

TABLE P-4-1

COMPARISON OF MAXIMUM INCREASED POLLUTANT CONCENTRATIONS WITH PSD INCREMENTAL LIMITATIONS

	SO_2 Concentration[a] (ug/m^3)			TSP Concentration[b] (ug/m^3)	
PSD Increments/Increment Consumption	3-Hour Average	24-Hour Average	Annual Average	24-Hour Average	Annual Average
Class II Areas					
Allowable PSD Class II increment	512	91	20	37	19
Paraho increment consumption	317	40	1	less than 16	less than 4
Increment consumption including baseline	319	40	1	less than 16	less than 4
Paraho increment consumption at Uintah and Ouray Indian Reservation	4	1	0	4	0
Increment consumption at Uintah and Ouray Indian Reservation including baseline	10	2	0	5	0
Class I Areas					
Allowable PSD Class I increment	25	5	2	10	5
Increment consumption at Flat Tops Wilderness Area (federal Class I)					
Paraho increment consumption	0	0	0	0	0
Increment consumption including baseline	0	0	0	0	0
Increment consumption at Maroon Bells-Snowmass Wilderness Area (federal Class I)					
Paraho increment consumption	0	0	0	0	0
Increment consumption including baseline	0	0	0	0	0

TABLE P-4-1 (Concluded)

COMPARISON OF MAXIMUM INCREASED POLLUTANT CONCENTRATIONS WITH PSD INCREMENTAL LIMITATIONS

PSD Increments/Increment Consumption	SO_2 Concentration[a] (ug/m^3) 3-Hour Average	24-Hour Average	Annual Average	TSP Concentration[b] (ug/m^3) 24-Hour Average	Annual Average
Increment consumption at Colorado National Monument (Colorado Category I and potential federal Class II)					
Paraho increment consumption	4	0	0	0	0
Increment consumption including baseline	6	1	0	0	0
Increment consumption at Colorado National Monument (Colorado Category I and potential federal Class II)					
Paraho increment consumption	0	0	0	0	0
Increment consumption including baseline	0	0	0	0	0

Note: For more information on the models used in this analysis, refer to Appendix R-G.

SO_2 = sulfur dioxide; TSP = total suspended particulates; ug/m^3 = micrograms per cubic meter.

[a]Calculated using SAI Gaussian Puff Model with 5-kilometer grid spacing.

[b]Class II increment calculated using EPA Complex I Model with 1-kilometer grid spacing; Class I consumption calculated using the SAI Gaussian Puff Model with 5-kilometer grid spacing.

TABLE P-4-2

COMPARISON OF MAXIMUM GROUND-LEVEL POLLUTANT CONCENTRATIONS WITH THE NATIONAL AMBIENT AIR QUALITY STANDARDS (NAAQS)

	Maximum Ground-Level Concentration (ug/m^3)			
Pollutant / Averaging Time	Baseline[a]	Paraho Impact	Total[c]	NAAQS (ug/m^3)
Sulfur dioxide (SO_2)				
3-Hour	10	327	327	1,300
24-Hour	1	41	41	365
Annual	0	1	1	80
Total suspended particulate (TSP)				
24-Hour	175	less than 16	less than 191	150
Annual	44	less than 4	less than 48	60
Nitrogen dioxide (NO_2)				
Annual	1	3	4	100
Carbon monoxide (CO)				
1-Hour	200	125	325	40,000
8-Hour	200	125	325	10,000
Ozone (O_3)				
1-Hour	70	2	72	240
Hydrocarbons (HC)				
3-Hour	100	24	124	160

Note: For more information on the models used in this analysis, refer to Appendix R-G.

ug/m^3 = micrograms per cubic meter.

[a]CO, HC, and O_3 estimated from air quality monitoring data; TSP estimated from Empirical Model; SO_2 and NO_2 estimated from disperison modeling.

[b]Calculated using SAI Gaussian Puff Model with 5-kilometer grid spacing, except TSP concentrations, which were estimated using the EPA Complex I Model with 5-kilometer grid spacing.

[c]It is conservatively assumed that baseline maximums and Paraho maximums coincide.

Additional visibility analyses indicated that reduction in visual range would not be significant at any potential or existing Class I areas based on the significance criteria given in Chapter R-4. For more detailed information on the visibility analysis, refer to Appendix R-G or the Air Quality Technical Report (Systems Applications Inc. 1982).

P-4.A.3 WATER RESOURCES

Surface Water

The Paraho operation would be a zero discharge process; therefore, the processing facilities would not alter the quality of any surface water supply. However, erosion during construction would contribute additional sediment to streams. This would be a temporary and insignificant impact. The 2,900 ac-ft/yr that Paraho proposes to withdraw from the White River represents 0.6 percent of the average annual flow. Withdrawal of this amount would not be a significant impact.

Floodplains

Impacts to floodplains are discussed in Section R-4.A.3, Water Resources.

Ground Water

The proposed mine shafts could encounter a more permeable zone of the Bird's Nest aquifer and would require dewatering during construction. The effect would be temporary and probably would not extend to the boundaries of the mine property. The mine, 300 to 500 feet below the Bird's Nest, might encounter a large open fracture or fracture zone extending to the Bird's Nest aquifer. Any water entering the mine would be recharged into the Bird's Nest through a well sufficently remote to prevent recirculation.

P-4.A.4 VEGETATION, SOILS, AND RECLAMATION

The acreages of vegetation and soils that would be disturbed during construction and occupied by the proposed project and alternative facilities are listed in Table P-4-3.

Reclamation measures, as outlined by the company, are expected to return understory vegetation to near preconstruction densities, which range from barren ground to 25 percent cover, within 3 to 10 years; shrubs and brush species would take up to 20 years. Therefore, impacts would be considered insignificant except in certain areas and under climatic conditions where noxious weeds could form the dominant ground cover, making establishment of native species of grasses and shrubs difficult.

Secondary impacts through off-road vehicles usage from the projected 1985 population increase could cause significant unquantifiable amount of damage to vegetation.

TABLE P-4-3

SUMMARY OF SURFACE ARE DISTURBED, OCCUPIED, RECLAIMED, GRAZING AND CROPLAND AFFECTED BY PROJECT COMPONENT

Project Components	Total Area Disturbed (Miles)	Total Area Disturbed (Acres)	Area Occupied for Project Life - 10 to 30 Years (Acres)	Area Reclaimed and Revegetated[a] (Acres)	Potential Grazing Losses[b] AUMs[c]	Potential Grazing Losses[b] Livestock Numbers[d]	Cropland Affected (Acres)	Prime Agri-cultural Land (Acres)
Proposed Action:								
Plant Site and Related Facilities	NA	433	292	141	29	6	0	0
Spent Shale Disposal Areas	NA	350[e]	350	350[f]	23	5	0	0
Access Roads	4.2	127	51	769	8	2	0	0
Water Supply System	2.7	32	0	32	2	0	0	0
Power Transmission Line	3.2	22	0	22	2	0	0	0
Product Pipeline	3.5	43	0	43	3	1	0	0
Construction Camp	NA	80	80	80	5	1	0	0
Off-site Urban Development[h]	NA	NA	NA	NA	NA	NA	933	280
TOTAL		1,087	773	1,437	72	15	933	280
Alternatives:								
Bonanza Power Plant Water Supply System	12	145	0	145	10	2	0	0

Note: NA = Not Applicable AUMS = Animal Unit Months

[a]Considered temporary disturbance with exception of the spent shale disposal area.

[b]Forage losses are considered only for long-term occupancy of grazing land. Linear construction disturbance would be revegetated. No grazing losses would occur unless the right-of-way would be fenced.

[c]AUM's computed at average rate of 15 species per AUM for all land ownerships.

[d]Livestock numbers are based on a 5-month grazing season. One unit = 1 cow or 1 horse or 5 sheep. (Source: BLM Grazing Records. Vernal, Utah)

[e]Disturbance would consist of surface soil removal for use in reclamation of spent shale disposal area.

[f]Reclamation of spent shale would be conducted concurrently with operations and would be protected from grazing during project life.

[g]Approximately 50 percent of road area consisting of road borrow pits would be revegetated and considered as removed from grazing livestock production.

[h]Cropland converted to urban uses due to project-related population increases in the Ashley Valley-Jensen areas.

No threatened or endangered plant species have been located in the project area. However, a recognized species of importance, White River penstemon (Penstemon albafluvis) has been located down stream on the White River and could be affected by people seeking increased recreation opportunities along the White River.

Soil loss from accelerated wind and water erosion caused by activities associated with construction of right-of-way facilities would occur until erosion control measures are implemented (1 year). Impacts to soils would generally be considered temporary, because soil loss is expected to be minimized with implementation of effective erosion control and revegetation measures outlined by the appplicant (Appendix R-J). However, impacts to soils would be significant if applicable erosion control measures are not implemented due to lack of compliance with approved plans and if adverse weather conditions (mainly heavy rainstorms) would occur during construction before any erosion control meaures could be installed.

Disturbance associated with the spent shale disposal area would occur on 400 acres. Land disturbance is expected to be minimal, because the disposal area consists of a deep, very sparsely vegetated canyon with extremely steep side slopes. The spent shale disposal operation would consist mainly of a filling procedure; the one open side facing the White River and the top would require reclamation. The surface of the spent shale would be shaped, stabilized, and made suitable for plant growth by reclamation measures and procedures outlined in Paraho's reclamation program. The spent shale disposal area would be covered with a 12- to 14-inch mantle of topsoil and soil material favorable for plant growth. The side facing the White River would be benched and stabilized with riprap. Special care would be required to control runoff from entering the White River. Reclamation is expected to be successful based on implementation of the applicable measures and from the demonstrated results of current field studies (Appendix R-J).

P-4.A.5 WILDLIFE

Habitat

This project would result in both direct and indirect losses of wildlife habitat. Direct losses of habitat from this project would total an estimated 1,087 acres (Table P-4-3). Of these direct habitat losses, an estimated 693 acres would be lost for the life of the project. Other direct losses of habitat include those acres that are not physically destroyed or modified but are close enough to project facilities to become temporarily unusable by wildlife because of isolation, dust, noise, similar factors. These acres cannot be estimated at present levels of knowledge. The long-term loss of an estimated 693 acres of habitat equals less than 1 percent of the habitat available in this area.

Wildlife Populations

Wildlife populations on the project could be lost or reduced with the initiation of this project. These losses would probably increase as the project moves into full production (1987) because of larger numbers of workers and related persons utilizing the wildlife resources of the area. Losses of animals could be directly caused by project construction and operation, or indirectly by poaching, wanton killing, collecting and similar activities.

Terrestrial Wildlife

Construction and operation activities of this project in high priority mule deer winter range could cause a population reduction. Harassment due to these activities could cause abortions and death of adult deer (Geist 1974). In addition, approximately 693 acres of high priority mule deer winter range would be lost in this area (394 acres from rights-of-way and 299 acres from the lease area). Based upon winter range maps furnished by the Utah Division of Wildlife Resources (1981), this acreage would equal about 0.1 percent of this class habitat.

The Paraho project development would also remove about 693 acres of high priority year-long pronghorn range (394 acres from rights-of-way and 299 acres from the lease area) for the life of the project (10 years). The acreage from the project area is approximately 0.3 percent of this type of pronghorn range north of the White River.

Removal of topsoil and storage for later reclamation, construction of ancillary facilities, and upgrading of access roads would cause direct mortality to small burrowing rodents. Losses on an estimated 693 acres would be heavy, but the high reproductive potential of these species indicate that repopulation of reclaimed areas would be rapid. The revegetation of disturbed areas to a grass complex could result in a different small mammal population, since small rodents that frequent shrub habitat would not infiltrate back into a reclaimed area planted to grass (BLM 1978c).

Mourning doves feed and nest on most of the proposed site, but habitat is marginal at best because of the uniformly poor quality habitat throughout the area. No data exist on nesting dove populations, but it can be stated that about 693 acres of poor quality nesting and feeding habitat would be lost over the life of the project (about 10 years). This loss of habitat and its estimated dove production is assumed to be less than 1 percent of the Uintah County dove population.

Some small nongame songbirds would be lost or displaced by the loss of 693 acres of desert shrub habitat. The best available bird population density estimates presently available for the project area indicate an average of 21 breeding pairs per 100 acres (BLM 1978c). This means a theoretical population loss of 146 breeding pairs of small birds would be possible through project development. It is anticipated that these losses would be less than 1 percent of the Uintah County population.

Raptors could be adversely affected by this project through the elimination of about 693 acres of prey habitat. Some nesting habitat for ground nesting raptors (such as marsh hawks and ferruginous hawks) would also be lost for the life of the project. Losses are not expected to be significant, however, as there appears to be ample nesting and foraging habitat throughout the areas adjacent to the project. An active golden eagle nest located on the cliffs southeast of the project area should be protected; otherwise, abandonment of the nest and lost production would result.

Direct losses of reptiles on about 693 acres for the life of the project and displacement on the same number of acres would total an estimated 1 percent or less of the regional population. Species reproduction is high enough that repopulation would be rapid once the project is abandoned.

The small amount of riparian habitat which would be disturbed by this project would have no adverse affect upon amphibian populations in the area.

Threatened or Endangered Species

Project activities are not anticipated to adversely affect the endangered fish species in the White River, because the water that would be purchased from the State of Utah would be pumped from the White River Reservoir.

P-4.A.6 AGRICULTURE

Cropland

Anticipated project-related population increases and associated support facilities would cause significant impacts to cropland (including prime agricultural land) because of land use conversion from cropland to other uses in the nearby Ashley Valley-Jensen and Rangely areas. An estimated 933 acres of cropland, including prime agricultural land, would be converted to homesites and other related urban developments (Table P-4-3, Section P-4.A.4). This land use conversion would contribute to the loss of cropland in the region, as discussed in Section R-4.A.6, Agriculture.

Grazing

The proposed action would remove 1,087 acres of vegetation and its production capacity for various periods of time. With successful reclamation procedures, 5 to 20 years after project abandonment would be required to reclaim the area to preconstruction production. Where rights-of-way would disturb vegetation during construction, it is anticipated that productive capacity would be restored within 5 years with implementation of the reclamation plan outlined by the company (Paraho 1982).

During construction, loss of forage would total approximately 76 AUMs (Table P-4-3, Section P-4.A.4) on less than 2 percent of the total allotment. Less than 1 percent of the productive capacity would be lost for the life of the project due to permanent structures. If 10 or more AUMs would be lost in any one allotment, reductions in allowable use would be made.

Impacts would be considered insignificant due to the relatively small loss of grazing capacity that would be spread over several lessees should the manager decide reductions would be necessary. However, increased traffic and recreation use associated with population increases could cause death, losses, and/or disruption of sheep grazing patterns during the winter thus creating significant secondary impacts.

P-4.A.7 TRANSPORTATION NETWORKS

It is estimated that approximately 1,500 additional work trips would be generated by the Paraho project in the peak operation year. The majority of this traffic would be destined for Vernal. By 1987, U.S. 40 from the county line to County Road 264 and from Vernal to Jensen would experience an unacceptable level of service. The level of service would be reduced to Level D (American Association of State Highway and Transportation Officials 1965). This means traffic flow would fluctuate in volume and would have temporary restrictions to flow, which could cause substantial drops in operating speeds.

The projected traffic volume and level of service analysis for the network is presented in the Socioeconomics Technical Report (State of Utah 1982b). There would be no impacts on new County Road "C."

Approximately 29 truck trips per day are predicted to be required during construction -- 6 to Salt Lake City, 14 to Vernal, and 9 to the east. Approximately 20 would be required during operation -- 10 to Salt Lake City, 6 to Vernal, and 4 to the east.

This represents approximately 3 percent of all the vehicle trips on new County Road "A." (During operation, the materials to be transported by truck include ammonia and sulfur.)

Some bulky equipment would need to be shipped by rail. The closest railheads of Mack, Craig or Salt Lake City would be used, depending on the origin of the equipment. The remaining trip from the railhead would need to be made by truck.

P-4.A.8 RECREATION

The implementation of the proposed Paraho project would directly disturb 1,087 acres of land from the recreation land base over the life of the project. Because dispersed recreation opportunities are limited within the project area, there would be relatively few impacts to recreation use. The project would cause a population increase of 5,117 people in 1985 (peak construction) and 4,239 people in 1987 (peak operation). Based on location of project components and population growth, the following impacts upon the recreation resource and users are anticipated.

The Paraho project would adversely affect the quality of floatboating and canoeing experiences along a 3-mile segment of the White River, particularly during late spring and early summer when river running is at maximum. The proposed side canyon benching for the spent shale disposal site, which would be immediately adjacent to the river, would be visible and therefore impair the feeling of remoteness and naturalness of the river canyon currently enjoyed by recreationists. Project-related noise such as spent shale disposal activity, heavy equipment operation, and blasting would also likely diminish the quality of the river recreational experience along this 3-mile segment.

Of greater adverse affect could be the permanent loss of a minimum of 3 miles of the White River from any further consideration as a National Wild and Scenic River. The introduction of visual, audible, or other sensory intrusions along the river would be incompatible with the "natural, cultural, and recreation values" of this inventoried river segment (Federal Register 1980a) and the spirit and intent of the Wild and Scenic Rivers Act (Public Law 90-542).

The anticipated 1,440 construction workers who would live on site in the mid-1980's would likely increase ORV activity, particularly during weekends when outdoor recreation use is known to be greater. This anticipated increase in ORV activity and the likelihood of a proliferation of new trails could cause resource protection problems (see Section S-4.A.4, Vegetation, Soils, and Reclamation; Section S-4.A.6, Agriculture; Section S-4.A.10, Cultural Resources) for local federal land managers in controlling weekend ORV use and limiting this use to existing vehicle routes on public lands.

At least a 26 percent increase in weekend fishing, primarily for channel catfish, could also be expected, from construction workers who could seek fishing opportunities on the White River (UDWR 1982).

Adverse impacts to deer hunting within the project area would be anticipated due to greater hunting competition for an already limited resource. Increased hunting competition would result, with greater hunter contacts and less hunting success. This would diminish the quality of hunting in the area. The incidence of poaching would also be expected to increase (Bradley 1976). However, adverse impacts on hunting experiences would not be considered significant, because several other areas within the area (Ouray National Wildlife Refuge; High Uinta Mountains) offer ample opportunities for a variety of high quality hunting experiences. Nonetheless, hunting is the primary recreational activity of this area based on yearly statistics compiled by the Utah Division of Wildlife (BLM 1973a),and it is enjoyed by a substantial number of hunters (see Section R-4.A.5, Wildlife, for hunting data in Uintah County).

Because Vernal, Utah, and Rangely, Colorado, have diverse municipal recreation facilities, the current supply of leisure activities within the community would meet the future needs of Paraho workers who may choose to reside there.

During the construction phase of the Paraho project, the majority of the work force are expected to live on site where indoor and outdoor recreation facilities are planned. It is unknown whether these facilities would adequately meet the leisure-time needs of the work force.

P-4.A.9 CULTURAL RESOURCES

The Paraho project would cause land modification that could adversely affect cultural resources as described in Section R-4.A.9, Cultural Resources. The lease area and approximately 7 miles of access road and utility rights-of-way have been surveyed for cultural resources in compliance with 36 CFR 800, E.O. 11593 and other historic preservation legislation. The remaining rights-of-way would be surveyed and evaluated for significant cultural resources.

P-4.A.10 VISUAL RESOURCES

The visual resources of the areas that would undergo significant adverse impacts as a result of the proposed action and alternatives (including the duration and total number of acres that would be affected) are summarized in Table P-4-4. The placement of the project in these areas would exceed the allowable levels of contrast for each Visual Resource Management (VRM) class established for specific portions of the project area. Areas where impacts would exceed the acceptable levels of contrast for a specified VRM class are placed in VRM Class V (indicating rehabilitation would be necessary). Refer to Section R-4.A.11, Visual Resources, for a description of the criteria used to determine significance of visual resource impacts which would be brought about if the project were constructed.

P-4.A.11 PALEONTOLOGY

Local fossil resources would be subjected to disturbance by construction activities and/or removal by collectors.

P-4.A.12 MINERAL AND ENERGY RESOURCES

The accompanying table is a summary of energies required by all major phases of the Paraho project. The methodology used to determine these figures is discussed in Section R-4.A.13, Mineral and Energy Resources, and Appendix R-L.

	Trillion Btu's/Year
Net Output	77,430
Energy in Shale	(118.800)
Other Fuels Used	(14.540)
Indirect Energy	((30.550)
Infrastructure	(16.330)
Total Input	180.220
Percent Efficiency	43.0%

This figure is on the same order of magnitude as could be expected from coal-fired electric power generation or producing oil by pumping a well.

TABLE P-4-4

SIGNIFICANT ADVERSE VISUAL RESOURCE IMPACTS

Component	VRM Class	Acres Significantly Affected	Location of Impact	Explanation
Proposed Action				
Mine	II	3	Portal entry and road as seen from White River (long-term); within lease area.	Contrast in vegetative clearing for road and mine entry area; landform contrast in same area as seen from White River.
Water Supply System	IV	6	Would cross country road (long-term); on private lands.	Contrast in vegetatiion clearing for pipeline one-half mile each side of county road.
Shale Disposal	II	100	South end of disposal area as seen from White River (long-term); within lease area.	Contrast in landform, vegetation clearing created by introducted landform.
Power Transmission Line	IV	6	Would cross county road (long-term); within right-of-way.	Contrast in vegetation clearing one-half mile each side of the county road. Contrast in electrical poles one-half mile each side of country road.
Product Pipeline	IV	12	Would cross county road (long-term); within right-of-way.	Contrast in vegetation clearing where line would cross county road one-half mile in either direction.
Alternative				
Bonanza Power Plant Water Supply System	IV	6	Would cross county road (long-term); on private lands.	Contrast in vegetation clearing for pipeline one-half mile each side of county road.

P-4.A.13 EXISTING LAND USE PLANS

The proposed Paraho project would conflict with BLM's Bonanza Management Frame Work Plan, which states that all right-of-ways are to be located within the designated corridors. As proposed, 1 mile of the power transmission line would be constructed outside of the right-of-way corridors designated in the plan (Map R-A-3, located in Appendix R-A). For land ownership designation, see Table P-1-1 (Section P-1.C.3).

P-4.B **BONANZA POWER PLANT ALTERNATIVE WATER SUPPLY SYSTEM**

Under this alternative, Green River water would be purchased from the Bonanza Power Plant and transported via a 12-mile long pipeline to the Paraho plant site. The route from the town of Bonanza to the plant site would be identical to the proposed action water pipeline route. The 2,900 ac-ft/yr that Paraho would purchase represents 0.06 percent of the average annual flow of that river; this would not significantly affect the flow or water quality of the Green River.

About 145 acres of mixed-desert shrub vegetation type would be disturbed by construction of the water pipeline. Because the land that would be affected by this alternative does not vary significantly from the land that would be affected by the proposed action, impacts of the alternative would be similar to those of the proposed action for socioeconomics, air quality, vegetation, soils, wildlife, cropland, transportation networks, recreation, wilderness, cultural resources, and visual resources. However, an additional 113 acres would be disturbed, because the alternative pipeline would be 9.3 miles longer.

The pipeline route would cross two grazing allotments that are used for winter grazing by sheep. Approximatly 10 AUMs of forage would be lost over the 12-mile for a period of 2 to 10 years, depending upon location.

P-4.C **NO-ACTION ALTERNATIVE**

Under the No-Action Alternative (denial of the federal rights-of-way for the proposed access road, product pipeline, and power transmission line), it would be possible for the Paraho project to be developed, provided that the proposed land exchange north of the Paraho project between BLM and the State of Utah (Section S-1.B.1, Leases) were approved and implemented. The necessary access road, product pipeline, and transmission line would be routed due north across state lands. Refer to the No-Action Alternative section of th Site-Specific Analyses Introduction of this EIS for an explanation of the purpose of this alternative. Although there would be a decrease in the acreage disturbed as compared to the proposed action, the characteristics of the areas affected would be very similar to the proposed routes. Therefore, the impacts to socioeconomics, air quality, water resources, soils, cropland, transportation networks, recreation, and wilderness would be similar to those of the proposed action (Section P-4.A).

Vegetation would be disturbed and removed during the construction and operation of the project. The acres removed and disturbed by the plant facilities, mine, and spent shale pile would be the same as for the proposed action (Section P-4.A.4, Table P-4-3). The rights-of-way for this alternative would disturb 127 acres of the desert shrub type during construction. This disturbance would occur over a period of 1 to 3 years, until vegetation is established. Reclamation of all but 24 acres would occur at the completion of construction. The access road would occupy 24 acres for the life of the project (10 years). No threatened or endangered plant species are located in this area.

The impacts to wildlife would basically be the same as for the proposed action. The habitat disturbance of 127 acres would still be in high priority mule deer winter range. Other impacts on wildlife would remain the same as for the proposed action.

The construction disturbance of 127 acres would result in a loss of approximately 11 AUMs of forage. Since more than 10 AUMs would be lost in one allotment, a reduction in exchange of use AUMs could be made, resulting in a reduction in livestock use.

The area for the rights-of-way has not been surveyed for cultural resources; therefore, impacts cannot be quantified at this time.

The rights-of-way under this alternative would be located in the same visual classes as for the proposed action. There should be less visual impact under this alternative, since the amount of disturbance due to the access road, product pipeline, and power transmission line would be less (127 acres versus 192 acres for the proposed action).

There should be no conflict with existing land use plans, since the rights-of-way would now be located on state land instead of public lands. The state has not established a right-of-way corridor.

Vegetation would be disturbed and removed during the construction and operation of the project. The acres removed and disturbed by the plant facilities, mine, and spent shale pile would be the same as for the proposed action (Section P-4.A.4, Table P-A-1). The rights-of-way for this alternative would disturb 127 acres of the desert shrub type during construction. This disturbance would occur over a period of 1 to 3 years, until vegetation is established. Reclamation of all but 24 acres would occur at the completion of construction. The access road would occupy 24 acres for the life of the project (10 years). No threatened or endangered plant species are located in this area.

The impacts to wildlife would basically be the same as for the proposed action. The habitat disturbance of 127 acres would all be in high priority mule deer winter range. Other impacts on wildlife would remain the same as for the proposed action.

The construction disturbance of 127 acres would result in a loss of approximately 11 AUMs of forage. Since more than 10 AUMs would be lost in one allotment, a reduction in exchange of use AUMs could be made, resulting in a reduction in livestock use.

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The rights-of-way under this alternative would be located in the same visual classes as for the proposed action. There should be less visual impact under this alternative, since the amount of disturbance due to the access road, product pipeline, and power transmission line would be less (127 acres versus 192 acres for the proposed action).

There should be no conflict with existing land use plans, since the rights-of-way would now be located on state land instead of public lands. The state has not established a right-of-way corridor.

P-5.A **CUMULATIVE IMPACTS**

Cumulative impacts result when a new project is developed in an area in which other projects exist or are proposed. Although the impacts for the individual projects might be minor, the impacts from all projects in an area would be significant. The interrelated projects considered in the cumulative impact analysis for the Paraho-Ute project are listed in Tables R-1-2 and R-1-3. The projects proposed by the other applicants were not considered here, because the cumulative impacts of all the applicants' were discussed in Chapter R-4, Regional Environmental Consequences.

The assessment of cumulative impacts for the Paraho-Ute project indicated the only major cumulative impacts would occur in socioeconomics, air quality, wildlife, agriculture, and recreation.

P-5.A.1 SOCIOECONOMICS

Population and Employment

Adding the effects of the interrelated projects and the effects of the Paraho project, population in the Uintah Basin would be expected to increase by 7,257 people in 1985 and 6,630 people in 1987. Uintah County would experience the most population and employment increases. In 1985, population increases over baseline for Uintah County would be 22.7 percent (5,849 persons); in 1987, the increase would be 14.4 percent (3,937 persons) over baseline. Employment increases would be more dramatic, with a 1985 increase over baseline of 40.9 percent (4,331 persons) and a 1987 growth of 57.0 percent (6,313 persons). Duchesne would incur a population increase in 1987 with an increase over baseline of 10.5 percent (1,903 persons). Employment increases would be relatively small. The Colorado area would have minimal increases in population and employment.

At the community level, Vernal would receive the majority of the population increase. In 1985, population would increase over baseline by 19.9 percent (1,854 persons); while in 1987, the increase would be 33.1 percent (3,333 persons). Roosevelt would also incur substantial population growth, with a 11.3 percent (614 persons) increase over baseline in 1985 and 21.4 percent (1,234 persons) in 1987. Dinosaur would have the greatest relative change, since it's baseline is so small (501 in 1985). In 1985, Dinosaur's population would exceed projected baseline by 36.3 percent (182 persons). For 1987, the percentage would be 79.8 (347 persons). Rangely would not be expected to have significant socioeconomic impacts, because the projected increase over baseline would be 4.7 percent (151 persons) in 1985 and 4.8 percent (162 persons) in 1987. (Although the Paraho project would be very close to Rangely, it was assumed that the poor condition of the road between Bonanza and the Colorado state line and Uintah County's non-maintenance policy for

this road would preclude commuter travel on the road. Thus, it was assumed that the travelway to Rangely was the Bonanza Road to SR 40 to SR 64. This, in turn, reduced the population allocations to the Colorado area. (Barber 1982)

Housing

With regard to housing demand, Uintah County would receive the largest increase in demand. In 1985, cumulative demand growth over baseline is projected at 17.1 percent (1,315 households). For 1987, the demand increase would decrease relative to baseline to 13.7 percent (1,104 households). Duchesne County would not have significant increases until 1987, when demand over baseline would be 11.6 percent.

For community housing impacts, Vernal would receive the largest increases. In 1985, increases would be 19.3 percent (595 households), while in 1987, baseline demand would be exceeded by 30.0 percent (987 households). Roosevelt would receive significant increases of 12.3 percent (199 households) and 23.7 percent (405 households), respectively. Dinosaur would have the largest proportional increase over baseline, with increases of 36.3 percent (56 households) in 1985 and 79.8 percent (106 households) in 1987.

With such large additional demands in housing and the relatively low vacancy rates, severe housing shortages would be likely in the short-term at least. This would likely worsen the existing problems with squatters on public and private lands.

Personal Income

Personal income increases produced by the Paraho project and the interrelated projects would equal $152.8 million (1980 dollars) in 1985 and $218.4 million in 1987.

Government Services and Facilities

In Uintah County, there would be a demand for 45 new classrooms and teachers by 1985 (16.5 percent increase over baseline). For 1987, there would be a demand for 61 (20.7 percent increase over baseline). Duchesne would have much smaller impacts (7.6 percent in 1987).

Uintah County's health services would increase. In 1985, demand over baseline would exceed 15.7 percent, while in 1987 demand over baseline would be 32.7 percent. There would be a demand for 18 additional nurses in 1987 for Uintah and Duchesne counties.

Demands for mental health services would be small, with demand for 2 social workers and 1 psychiatrist in 1987.

Most of the law enforcement impacts would center in Uintah County and the community of Vernal. In 1985, Uintah County would have a demand for 4 additional police officers over baseline; while in 1987, this number would be 8. Vernal would be more severely affected, with additional demands of 23 and 31, respectively.

Vernal's sewer service demand would increase over the baseline demand by 33.1 percent in 1987. Unless the proposed sewer system is constructed on schedule demand would exceed capacity. Roosevelt has adequate existing capacity to handle any increase in demands above baseline.

Vernal's demand for water connections would be 19.9 percent above baseline implemented, if the additional demand were to be met. Roosevelt could handle, with its existing system, any increases in demand.

Uintah and Ouray Indian Reservation

Adding interrelated projects to potential impacts from the Paraho project would substantially increase the potential impacts to the reservation. This is because the impacts from the Paraho project alone are expected to be not very significant given the substantial distance from the reservation. Impacts from the Paraho project and the interrelated projects would be the same as those described in Section R-4.A.1, Socioeconomics. However, impacts would be much less than the cumulative effects from all projects discussed in the regional analysis.

Quality of Life

This level of development would have significant social effects in Duchesne and Uintah counties, Utah. The Colorado area impacts would be minimal. Vernal and other Ashley Valley communities would be affected with particular intensity. While these effects would be somewhat less intensive and extensive than those described under the High-level Scenario (Section R-4.A.1, Socioeconomics), they would be very similar in nature.

P-5.A.2 AIR QUALITY

The cumulative PSD increment consumption from baseline sources, the Paraho project, and interrelated projects are compared to the PSD incremental limitations in Table P-5-1, which shows that no PSD incremental limitations would be exceeded.

Cumulative maximum ground-level pollutant concentrations are compared with the NAAQS in Table P-5-2. Cumulative particulate impacts would increase the high existing total suspended particulates concentrations, violating the NAAQS 24-hour standard. All other NAAQS would be complied with.

TABLE P-5-1

COMPARISON OF PSD INCREMENTS WITH
CUMULATIVE INCREMENT CONSUMPTION

PSD Increments/Increment Consumption	SO_2 Concentration (ug/m^3)[a] 3-Hour Average	24-Hour Average	Annual Average	TSP Concentration (ug/m^3)[b] 24-Hour Average	Annual Average
Class II Areas					
PSD Class II increment	512	91	20	37	19
Cumulative increment consumption	322	41	1	less than 25	less than 5
Cumulative increment consumption at Uintah and Ouray Indian Reservation	18	4	0	7	2
Class I Areas					
PSD Class I increment	25	5	2	10	5
Cumulative increment consumption at Flat Tops Wilderness Area (federal Class I)	1	0	0	0	0
Cumulative increment consumption at Maroon Bells-Snowmass Wilderness Area (federal Class I)	0	0	0	0	0
Cumulative increment consumption at Dinosaur National Monument (Colorado Category I and potential federal Class I)	10	1	0	1	0
Cumulative increment consumption at Colorado National Monument (Colorado Category I and potential federal Class I)	0	0	0	0	0

[a] Calculated using the SAI Gaussian Puff Model with a 5-kilometer grid spacing.
[b] Class II increment calculated using EPA Complex I Model with a 1-kilometer grid spacing; Class I consumption calculated using the SAI Gaussian Puff Model with a 5-kilometer grid spacing.

TABLE P-5-2

COMPARISON OF CUMULATIVE MAXIMUM GROUND-LEVEL POLLUTANT CONCENTRATIONS WITH THE NATIONAL AMBIENT AIR QUALITY STANDARDS (NAAQS)

Pollutant/Averaging Time	Maximum Cumulative Ground-Level/Concentrations (ug/m^3)[a]	NAAQS ug/m^3
Sulfur Dioxide (SO_2)	333	1,300
3-Hour	42	365
24-Hour	1	80
Total Suspended Particulate (TSP)		
24-Hour	less than 200	150
Annual	less than 49	60
Nitrogen Dioxide (NO_2)		
Annual	4	100
Carbon Monoxide (CO)		
1-Hour	327	40,000
8-Hour	327	10,000
Ozone (O_3)		
1-Hour	72	240
Hydrocarbons (HC)		
3-Hour	124	160

NOTE: It is conservatively assumed that baseline maximum, Paraho maximum, and interrelated projects maximum all coincide.
ug/m^3 = micrograms per cubic meter

[a]Includes baseline, applicants' facility, and interrelated projects.

Because the White River Shale project is in close proximity to the Paraho tract and the wind directions necessary to transport plumes from the White River Shale and the Paraho plant sites to Dinosaur National Monument vary by only a few degrees, cumulative visibility impacts may occur at Dinosaur. The frequency of occurrence and magnitude of the possible atmospheric discoloration identified in Section R-4.A.2, Air Quality, may be greater than for the projects individually due to the synergistic effects caused by interaction of the two plumes.

P-5.A.3 WILDLIFE

The influx of new people into Uintah County due to the Paraho project and interrelated projects would cause direct and indirect impacts to wildlife. (Uintah County is the only area where cumulative impacts to wildlife as a result of implementing the Paraho project and interrelated projects are expected to be significant.) Indirect impacts to wildlife caused by an estimated influx of 5,849 new people in 1985 and 3,937 new people in 1987 include, but are not limited to harassment, poaching, and wanton killing, resulting in possible wildlife population reductions. It is estimated that losses from poaching and wanton killings would increase about 22.7 percent by 1985 and by 14.4 percent by 1987 because of the increase in human population. Other indirect impacts include an estimated 22.7 percent increase in demand for the opportunity to hunt and fish by 1985. There would also be a 22.7 percent increase in competition for limited licenses or permits by 1985, which would reduce the chances of local sportsmen obtaining these permits at the same rate they now enjoy.

P-5.A.4 AGRICULTURE

Implementation of the proposed Paraho project along with the interrelated projects would cause a predicted population increase of 6,630 people in the Uintah Basin by 1987. This would result in the conversion of an estimated 1,459 acres of cropland, including prime agricultural land, to homesites and other related urban development in the Ashley Valley and Rangely areas. This land use conversion would contribute to the loss of cropland in the region, as discussed in Section R-4.A.6, Agriculture.

P-5.A.5 RECREATION

Based on the expected cumulative construction-related population growth in the area of influence (Uintah and Duchesne counties, Utah; Grand, Mesa, Moffat, and Rio Blanco counties, Colorado) of 10,131 people in 1985 (peak construction) and a cumulative operation-related population growth of 19,052 people in 1987 (peak operation), cumulative significant impacts would likely result to hunting, water-oriented recreation, and municipal leisure-time activities.

Not only would a loss of game animal habitat occur due to the Paraho project as well as interrelated projects, but due to the population growth projections stated above, hunting success would generally diminish because of increased competition for deer and antelope found in the general area. The incidences of hunting contact would likely be more common. Construction and operation-related noises could scare wildlife. Poaching would also be expected to increase during the off-hunting season (Bradley 1976). All of these environmental consequences would adversely affect the quality of the hunting experience in the Paraho project area and adjacent areas.

However, the development of the proposed White River Dam Project could significantly enhance waterfowl hunting as well as create a new spectrum of water-based recreation opportunities for the Paraho work force, especially for workers living at the on-site construction camp.

Deficiencies in the quality and supply of municipal leisure-time indoor facilities in Vernal and Roosevelt, Utah, and Rangely, Colorado, would be anticipated. By 1987 (peak operation year), there would be a 33.1 percent increase over baseline projections in people expected to be permanently residing in Vernal, a 21.4 percent increase in Roosevelt, and a ____ percent increase in Rangely. Vernal currently needs an additional year-round indoor swimming facility (DOE 1981), and more day-use park acreage in Rangely (Bartlett 1982). The need for these types of facilities as well as others are expected to increase in Vernal, Roosevelt, and Rangely as demands for quality recreation facilities and activities become more acute.

P-5.B TRENDS HAVING SIGNIFICANT IMPACT

P-5.C BENEFITS AND TRADE-OFFS

A minimum of three miles of the White River could lose its national significance relating to natural, cultural, and recreational values.

P-5.D COMMITMENT OF RESOURCES

Cultural resources are nonrenewable and irreplaceable and their physical destruction would be a commitment of the resource for the Paraho project. This would occur to those significant cultural resources that could not be avoided or mitigated and to buried, unknown cultural resources that are destroyed during land modification.

Not only would a loss of game animal habitat occur due to the Paraho project as well as other related projects, but due to the population growth projections stated above, hunting success would generally diminish because of increased competition for deer and antelope found in the general area. The incidence of hunting contact would likely be more common. Construction and operation-related noises could scare wildlife. Poaching would also be expected to increase during the off-hunting season (Bradley 1976). All of these environmental consequences would adversely affect the quality of the hunting experience in the Paraho project area and adjacent areas.

However, the development of the proposed White River Dam Project could significantly enhance waterfowl hunting as well as create a new spectrum of water-based recreation opportunities for the Paraho work force, especially for workers living at the on-site construction camp.

Deficiencies in the quality and supply of municipal leisure-time indoor facilities in Vernal and Roosevelt, Utah, and Rangely, Colorado, would be anticipated. By 1997 (peak operation year), there would be a 33.3 percent increase over baseline projections in people expected to be permanently residing in Vernal, a 21.4 percent increase in Roosevelt, and a ____ percent increase in Rangely. Vernal currently needs an additional year-round indoor swimming facility (BOR 1983), and more day-use park acreage in Rangely (Bartlett 1982). The need for these types of facilities as well as others are expected to increase in Vernal, Roosevelt, and Rangely as demands for quality recreation facilities and activities become more acute.

P-5.8 TRENDS HAVING SIGNIFICANT IMPACT

P-5.C BENEFITS AND TRADE-OFFS

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Cultural resources are nonrenewable and irreplaceable and their physical destruction would be a commitment of the resource for the Paraho project. This would occur to those significant cultural resources that could not be avoided or mitigated and to buried, unknown cultural resources that are destroyed during land modification.

DESCRIPTION OF PROPOSED ACTION AND ALTERNATIVES

S-1.A INTRODUCTION

Syntana-Utah proposes to develop the Syntana-Utah project, a shale oil production facility. The plant site would be located on a 8,648-acre lease in Uintah County, Utah. Development of this project would require the issuance of several rights-of-way by the Vernal District of the Bureau of Land Management (BLM).

Syntana-Utah proposes to develop the project in two phases. Construction of the initial phase would begin in 1983 and continue through 1986 when initial production of 16,500 barrels per stream day (bpsd) of upgraded shale oil would begin. Construction of the maximum phase would begin in 1988 and continue through 1994. The maximum phase production level would be 57,000 bpsd. In accordance with CEQ regulations, impact analyses are based upon the maximum production level to cover the "worst-case" situation.

This chapter focuses on impact-causing aspects of the proposed project and alternatives to that project. More detailed information about all aspects of the Syntana-Utah project is included in Project Description of the Commercial Shale Oil Production Facility Bonanza, Utah (Syntana-Utah 1982). Copies of this report are available from Mr. Robert Lee, Syntana-Utah, 601 Jefferson, 40th Floor, Houston, Texas 77002. Copies are also available for review in public libraries in the Uintah Basin and in the Salt Lake City and Denver main public libraries.

S-1.A.1 PURPOSE AND NEED OF THE PROPOSED PROJECT

Purpose

The purpose of the proposed project is to produce 16,500 bpsd of upgraded shale oil at initial capacity and 57,000 bpsd of upgraded shale oil at maximum capacity. In addition, approximately 63 tons per stream day (tpsd) of sulfur and 215 tpsd of ammonia would be produced as by-products at maximum capacity.

Need

The need for this project and other proposed synthetic fuel projects in the Uintah Basin is similar. This need is discussed in the Site-Specific Analyses Introduction of this environmental impact statement (EIS).

S-1.A.2 LOCATION

The Syntana-Utah project would be located in eastern Uintah County, Utah, near the White River and the Utah/Colorado border (Map R-1-1 in Section R-1.A).

Communities within the vicinity include Bonanza, Utah (about 5 miles southwest of the project site--accessed via State Highway 45), and Vernal, Utah (about 50 miles northwest of the project site--accessed via State Highway 45 and U.S. Highway 40).

S-1.A.3 AUTHORIZING ACTIONS

To implement the Syntana-Utah project, certain federal, state, and local authorizing actions would have to be taken. Most of the actions that would be required to authorize the various proposed synfuel projects in Uintah County are similar. These are identified in the Site-Specific Analyses Introduction of this EIS. Specific BLM actions that would be required for authorization of the Syntana-Utah project are granting the following rights-of-way across federal land:

- 7.2 miles for water pipelines
- 7.6 miles for product pipelines
- 17.2 miles for natural gas pipelines

Syntana-Utah has applied for all these rights-of-way.

S-1.A.4 INTERRELATIONSHIPS WITH OTHER PLANNED PROJECTS AND SPECIAL MANAGEMENT AREAS

Projects

The other planned and/or proposed projects that would occur within the area of influence of Uintah Basin synfuels development are shown on Tables R-1-2 and R-1-3 in Section R-1.A.

Special Management Areas

None of the proposed project components would lie within, be adjacent to, or cross any special management areas, such as a wildlife refuge or wilderness area.

S-1.B **HISTORY AND BACKGROUND**

S-1.B.1 LEASES

Syntana-Utah has obtained approximately 8,648 acres of mineral reserves for their project. These reserves reflect a combination of mineral leases acquired from the State of Utah and negotiated with private landowners. The state leases make up 7,932 acres. These leases were granted in 1963 for a period of 20 years. Because the holders of the leases have met the requirements of the lease terms, the leases will be extended for another 10 years. The remaining 716 acres are privately owned.

Currently, the leased acreage is not located in one single area; it occurs as separate parcels. To form a logical, consolidated mining unit, Syntana-Utah has formally requested that the State of Utah exchange state-owned lands for BLM lands adjacent to Syntana-Utah's largest existing state-leased holdings, thus transferring Syntana-Utah's state leases to those lands (Map S-1-1). The BLM plans to prepare an Environmental Assessment on the proposed land exchange, pending the outcome of the Minerals Management Service resource valuation studies. The impact analysis in this EIS is based on the assumption that a land exchange will eventually be completed and a logical, consolidated mining unit formed for the Syntana-Utah project. This exchange is not necessary to support the initial phase of the project.

S-1.B.2 PERMITS

Syntana-Utah received approval (March 1982) by the State Bureau of Air Quality to use the White River Shale Project meteorological representativeness air quality data to prepare the federal Prevention of Significant Deterioration (PSD) application. The Environmental Protection Agency (Region VIII) approved the use of this data in September 1981.

Water for construction and initial start-up would be purchased from the American Gilsonite Company. Syntana-Utah plans to obtain water needed for maximum production from the State of Utah and has received a letter from the Division of Water Resources stating that adequate water would be available from the proposed White River Dam Project.

S-1.C OVERVIEW OF PROPOSED ACTION AND ALTERNATIVES

S-1.C.1 GENERAL DESCRIPTION

The proposed Syntana-Utah project would involve the mining and processing of oil shale, the disposal of waste products, and the transportation of synthetic, upgraded shale oil to markets in the Petroleum Allocation District (PAD) II area (midwestern U.S.).

The proposed project would consist of the following major components:

1. underground room-and-pillar mine and associated facilities occupying 380 surface acres (mine depth ranging from zero feet at the outcrop to a weighted average 1,100 feet)

2. processing plant with Superior and TOSCO retorts (during maximum phase) and upgrading facilities (located on the plant site)

3. 16.5-mile pipeline to Rangely, Colorado, for distribution to Midwest (PAD II) refineries

4. spent shale disposal system, including a 3,440-acre disposal area

5. ancillary facilities including
   - access road (0.3 miles)
   - two water pipelines within the same right-of-way (6 miles)
   - two natural gas pipelines within the same right-of-way (11 miles)
   - power supply system
   - solid and hazardous waste disposal systems
   - steam and power generation facilities
   - communication system (4 miles)

The overall project schedule, as submitted by Syntana-Utah, is shown in Figure S-1-1. The schedule is subject to change based on completion of the EIS and decisions on the requested rights-of-way. Expansion to the maximum production phase is predicated on consummation of the state and federal land exchange. The estimated time required from start of construction to full-scale production is five years.

In addition to the proposed project, the following alternatives were analyzed: (1) project alternative -- no-action; and (2) component alternatives -- Green River Alternative Water Supply System, Disposal Area Bypass Alternative, and Mormon Gap Alternative Natural Gas Pipeline.

S-1.C.2 LOCATION

The proposed plant site would lie within Township 9 South, Range 25 East, encompassing acreage in Sections 1, 2, 9, 10, 11, 12, 13, 14, 15, 16, 17, 20, 21, 22, 23, and 29. Map S-1-1 shows the project components located on the lease area. Maps R-A-1 and R-A-2 (located in Appendix R-A) show the location of all proposed and alternative components in relation to the other proposed synfuel projects in the Uintah Basin.

S-1.C.3 LAND STATUS AND OWNERSHIP

The proposed project area, including components of the lease area and the off-site rights-of-way, would involve federal, state, and private lands. Table S-1-1 shows the miles and acres of each type of land required for components of the proposed action and alternatives. Map R-A-3 located in Appendix R-A graphically shows the land ownership.

S-1.D PROPOSED ACTION

S-1.D.1 CONSTRUCTION, OPERATION, MAINTENANCE, AND ABANDONMENT

<u>Construction</u>

Construction of the project would begin in the last half of 1983 with the opening of the mine area. The project would be developed in two phases. As shown on Figure S-1-1, construction of the initial phase would be completed in

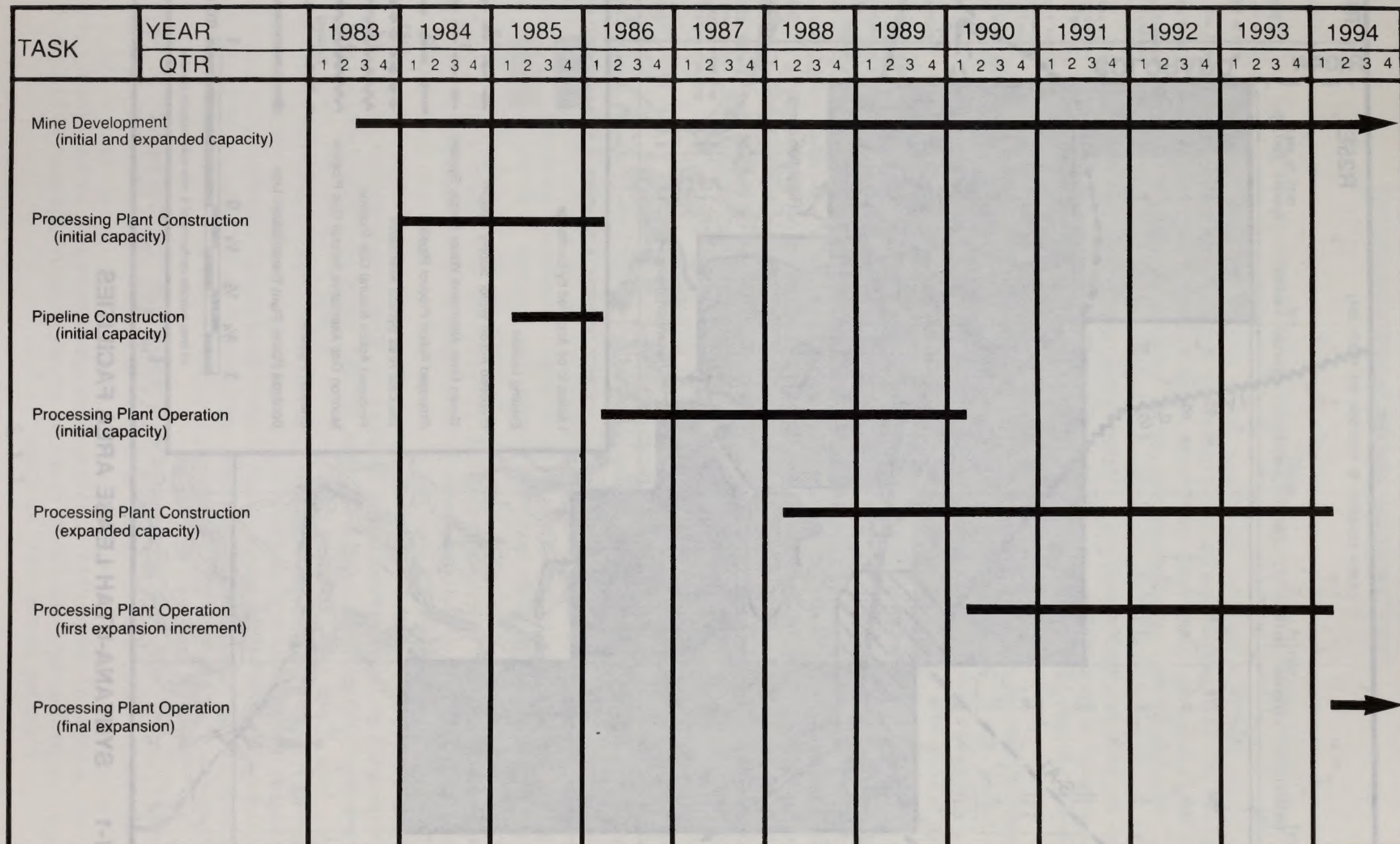
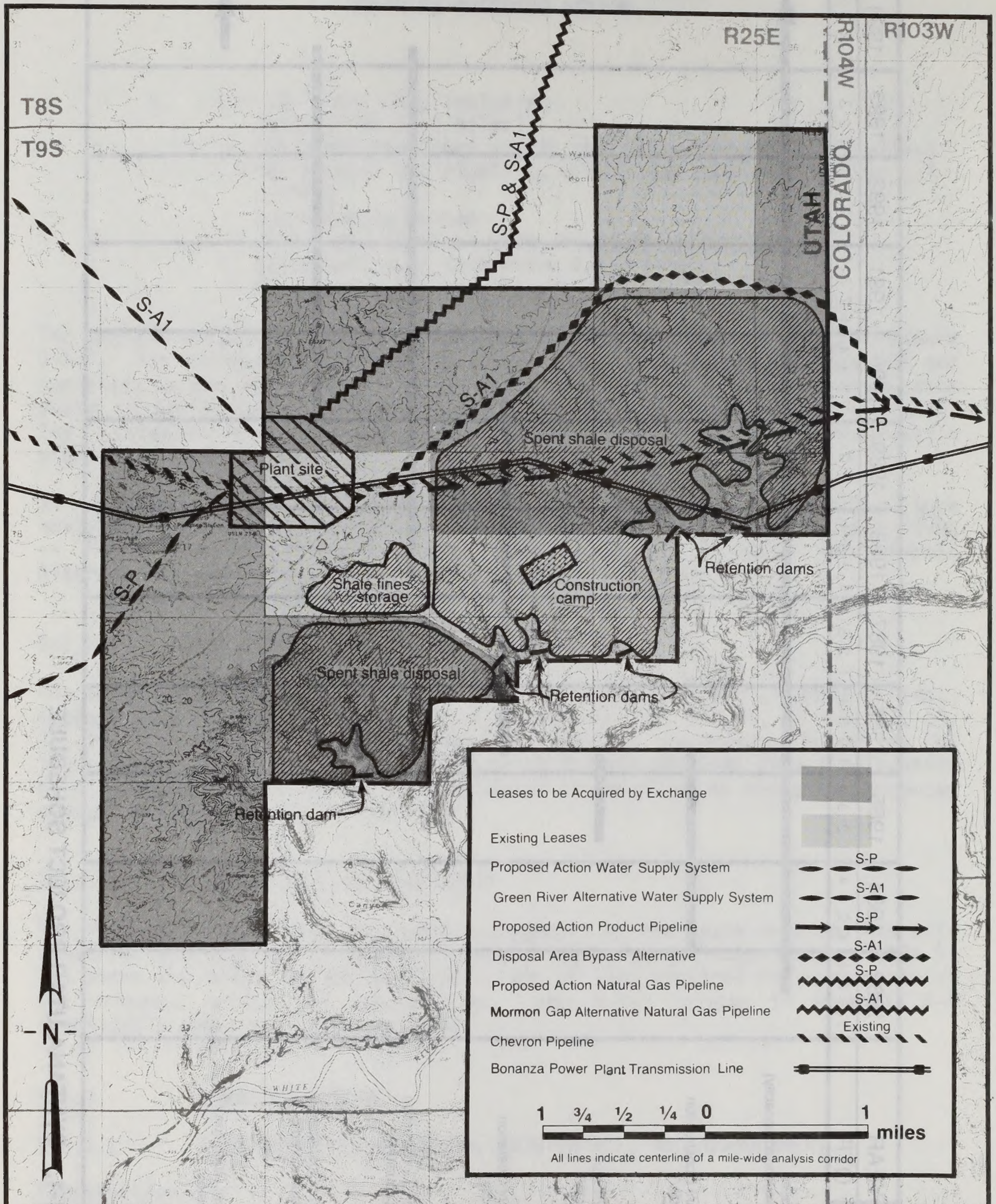


FIGURE S-1-1. SYNTANA-UTAH PROJECT SCHEDULE



MAP S-1-1 SYNTANA-UTAH LEASE AREA FACILITIES

TABLE S-1-1

LAND STATUS AND OWNERSHIP OF DISTURBED ACRES

Component	State of Utah (Miles)	State of Utah (Acres)	BLM (Miles)	BLM (Acres)	Indian (Miles)	Indian (Acres)	Private (Miles)	Private (Acres)	Total (Miles)	Total (Acres)[a]
PROPOSED ACTION										
Mine and Plant	NA	3,440	NA	0	NA	0	NA	610	NA	4,050
Access Road	0	0	0	0	0	0	0.3	2	0.3	2
Water Pipeline										
10" diameter	1.9	9	3.6	18	0	0	0.5	2	6	29
12" diameter	1.9	9	3.6	18	0	0	0.5	2	6	29
Natural Gas Pipeline										
6" diameter	2.4	12	8.6	41	0	0	0	0	11	53
8" diameter	2.4	12	8.6	41	0	0	0	0	11	53
Product Pipeline										
10" diameter	2.5	12	3.8	18	0	0	10.2	50	16.5	80
12" diameter	2.5	12	3.8	18	0	0	10.2	50	16.5	80
Communication System	0	0	0	0	0	0	4	10	4	10
TOTAL	13.6	3,506	32	154	0	0	25.7	726	71.3	4,386
ALTERNATIVES										
Green River Water Supply System										
12" diameter pipeline	4.3	21	23.7	114	0	0	0.4	2	28.4	137
20" diameter pipeline	4.3	21	23.7	114	0	0	0.4	2	28.4	137
Total	8.6	42	47.4	228	0	0	0.8	4	56.8	274
Disposal Area Bypass	3.8	128	0	0	0	0	0	0	3.8	128
Mormon Gap Natural Gas Pipeline										
6" diameter pipeline	1.4	7	8.8	42	0	0	.8	4	11	53
8" diameter pipeline	1.4	7	8.8	42	0	0	.8	4	11	53
Total	2.8	14	17.6	84	0	0	1.6	8	22	106

NA = Not Applicable.

[a]Maximum right-of-way width is assumed for a "worst-case" situation.

1986. Construction of the maximum phase would begin in 1988 and be completed in 1994.

A total of 610 acres would be disturbed during construction of plant site facilities. For the initial phase, the water, natural gas, and product pipelines would be constructed to meet initial capacity (16,500 bpsd). To expand to the maximum production level, additional, larger capacity pipelines would be constructed parallel to the original pipelines. Consequently, the 162-acres of right-of-way corridors would be disturbed twice during the phased construction period.

Because of the phased development of the project, the size of the construction work force would fluctuate. It would increase to a peak of 1,525 workers in 1985, decrease to 125 by 1987, increase to 1,350 by 1989, decrease again to 125 by 1991, and increase to 1,350 by 1993 before its final decline to zero in 1995.

Construction workers would be housed on a 25-acre construction camp (which would comply with all applicable regulations governing operation) located southeast of the plant site in the area where spent shale would eventually be disposed (Map S-1-1). The construction camp would consist of modular bachelor units for 1,000 workers, cafeteria, service facilities, limited recreation facilities, packaged sewer treatment plant, temporary potable water treatment facilities, and temporary electrical substation.

A maximum of 175,000 tons of construction equipment, materials, and supplies would be shipped by rail to Craig, Colorado, or Salt Lake City, Utah. Approximately 75 percent of this material would be trucked to the site by caravans consisting of 10 to 30 trucks during off-peak highway travel hours. The remaining 25 percent would be transported by single trucks. Concrete would be shipped in bulk by rail to Craig, Colorado, then loaded on 28-ton tanker trucks. Aggregate and sand would be trucked from Vernal. The route from Salt Lake City would follow U.S. Highway 40 to Vernal, turning south on Highway 45 to Bonanza, then northeast to the site via the Uintah County road. Shipments from Craig would follow U.S. Highway 40 to Vernal and then along the same route to the site.

Only the Uintah County road from Bonanza to the Syntana-Utah plant site would require upgrading. This would be done by the major project contractor.

The water required for the initial construction phase would be purchased from the American Gilsonite Company and transported to the project site via an existing pipeline. The power supply for the initial construction phase would come from diesel generators and the existing 138-kV line running across the northern part of the project site.

Standard operating procedures which would be implemented to minimize environmental impacts from construction include:

- Overall disturbed construction acreage would be minimized.
- Reclamation would be done in accordance with the reclamation program summarized in Appendix R-J.

- Construction would be scheduled to coincide with periods when soils are dry, especially in clayey soils.
- Periods when disturbed areas would be left unreclaimed would be minimized (especially in areas of high erosion).
- Dust would be controlled by applying chemicals or water and restricting vehicle traffic (speeds, routes, and frequency).
- Noise would be restricted by ensuring all diesel equipment and dust collectors have operational exhaust mufflers and by minimizing vehicle traffic.
- Color and shape of facilities would be compatible and blend with existing landscape.
- Socioeconomic impacts would be minimized by provision of prepayment of tax funds and management.

Operation and Maintenance

Operation of the Syntana-Utah project would involve mining the oil shale, conveying it to the retort process area, processing the oil shale, treating the waste products, transporting the upgraded shale oil and by-products to markets, and disposing of the spent shale.

The initial phase would produce 16,500 bpsd or 5,475,000 barrels per year of upgraded oil beginning in 1986. One Superior retort facility would be utilized. Expansion to a maximum production level of 57,000 bpsd or 18,725,000 barrels per year would occur by 1994. Production at this level would continue through 2014. Three Superior retort facilities and one TOSCO retort facility would be utilized at maximum production.

A peak work force of 2,100 workers would be needed to operate the facility at maximum production level. These workers would be housed in the local communities of Vernal, Jensen, and Bonanza, Utah and Dinosaur, Colorado.

At full production 63 tpsd of sulfur, 215 tpsd of ammonia, and 345 pounds per stream day of arsenic would be produced as by-products. The sulfur would be transported to a railhead at Craig, Colorado, in two 28-ton capacity enclosed tanker-type on-highway trucks. Each truck would make five trips every two months. (The by-products would be stored on site between truck trips.) The trucks would follow the Uintah County road crossing Section 16 to Route 45 to Bonanza, then on State Highway 45 to U.S. Highway 40, then east on U.S. Highway 40 to Craig, Colorado. Two 28-ton tanker-type trucks would transport the ammonia to a railroad at Craig, Colorado every operating day of the month. The previously described route to Craig would be followed. It is anticipated that two storage tanks, one each for ammonia and sulfur (each tank would be less than 1000-ton capacity), would be necessary at the Craig railhead.

Air pollutant emissions from the project would comply with all applicable state and federal emission standards and regulations. Best available control technology would be installed where required. The major pollutant emissions at full production would be nitrogen oxides (746 kilograms per hour (kg/hr)),

sulfur oxides (128 kg/hr), total suspended particulates (121 kg/hr), carbon monoxide (64 kg/hr), and hydrocarbons (81 kg/hr).

Measures which would be employed to minimize environmental impacts during operation include:

- Monitoring would be employed, where required, to detect environmental effects.
- Ground waters would be protected by diking all oil, diesel fuel, and hazardous substance storage areas, and directing percolating ground water away from mineral extraction and mobilized zones.
- Areas of potential subsidence would be fenced off.
- Drainage would be improved in areas of slope instability.
- Dust and particulate matter would be controlled by surfacing of major access routes and parking lots; using water and chemical stabilizers, where appropriate; and restricting traffic (frequency, speeds, routes).
- Surface waters would be protected by treating domestic and human wastes, disposing chemical sludges in contained areas, and recycling treated water for reuse.
- Noise would be controlled by using operational mufflers on all equipment and noise silencers in mine ventilation shafts.
- Employee and public education programs would be used to sensitize people to the need for minimizing disturbance to wildlife.

In addition, special considerations that would minimize or avoid hazardous spills would be incorporated in tank and pipe design. In the event of a spill, a system of dikes would contain the movement of any hazardous material. Clean-up operations would be conducted using the safest and most expeditious methods available. Materials that would be handled and/or transported and thus run the risk of a spill or rupture are product oil, anhydrous ammonia, sulfur, arsenic, sulfuric acid, phosphoric acid, sodium hydroxide, and chlorine.

Hazardous and toxic materials would be handled and stored in accordance with applicable federal and state regulations.

Abandonment

At the end of the project life (30 years), surface facilities would be removed and the land reclaimed in accordance with the reclamation program outlined in Appendix R-J. Pipelines would be left in the ground.

S-1.D.2 PROJECT COMPONENTS

The General Mining, Processing, and Upgrading Techniques section included in the Site-Specific Analyses Introduction of this EIS describes, in a general way, the mining, processing, and upgrading facilities that would be used in the Syntana-Utah project. This section includes specific details about these facilities that are pertinent to the Syntana-Utah project as well as details

about the materials handling system, wastewater treatment systems, product pipeline, spent shale disposal area, and ancillary facilities.

Mine

The Syntana-Utah project would use a conventional underground room-and-pillar mine designed to excavate 26,630 tpsd of raw shale. The capacity would increase to 52,260 tpsd by mid-1990 and 84,500 tpsd at maximum capacity in 1994. Mining would continue at this rate until 2014 when the project would end. A total mineable tonnage of over 700 million tons is projected.

The initial (top cut) stage would excavate rooms 30-feet high and 55-feet wide and would leave 65-foot square pillars for support. The second (bench cut) stage would excavate a 30-foot deep section from the floor of the rooms. Broken ore would be loaded by 12-cubic yard front-end loaders into 50-ton end dump trucks for haulage to the underground primary crusher.

Materials Handling System

The primary crushed ore would be transported from the mine to the surface by the production slope conveyor and deposited in a raw shale pile. Ore from the raw shale pile would be fed to a secondary crusher station. Here, the ore would be crushed into two sizes; separate storage piles would be used for each size. The smaller sized shale (or fines) would be stockpiled until expansion would permit their use in the TOSCO retort. The larger size would be fed directly to the Superior retorts.

Retorting and Upgrading System

At full production, the Syntana-Utah project would produce raw shale oil using two types of retorting facilities - the Superior retort and the TOSCO retort, which are discussed in more detail in the Site-Specific Analysis Introduction of this EIS. The raw shale oil would have different composition than average crude oil. It would contain olefins, arsenic, organic oxygen, and ash; have a much higher concentration of nitrogen; and have a somewhat lower hydrogen/carbon ratio.

To convert the raw shale oil into an oil which can be processed in a normal refinery, the oil would be modified so that it could be transported through common carrier crude oil pipelines. This would be done by hydrotreating the raw shale oil.

The hydrotreating process raises the hydrogen content of the hydrocarbon liquids and vapors to increase the hydrogen/carbon ratio. The hydrogen would be manufactured by reforming natural gas, which would have been pipelined to the plant. The upgraded shale oil would then be ready for transport to markets via a common carrier pipeline.

By-products, such as gases and wastewater, would be sent to various facilities for processing.

Scrubbers would treat emissions. To control sulfur dioxide emissions from the steam boiler, a spray dryer would spray the flue gas stream with a lime slurry. The lime would remove the sulfur dioxide and the water would cool the lime and calcium sulfates. The system would remove at least 90 percent of the sulfur dioxide and would have a particulate emission of 0.01 grains per cubic foot. The dry powder would be removed and split. Some would be recycled back to the spray dryer and some would be sent to an environmentally acceptable disposal.

Wastewater Treatment Systems

A Chevron wastewater treatment system would be utilized to treat process wastewater. This unit produces a stripped water stream suitable for reuse in the plant. Products from the Chevron unit would include ammonia and hydrogen sulfide. The hydrogen sulfide would be processed to remove sulfur. The ammonia (anhydrous ammonia) would be sold.

The effluent wastewater system would remove organic, inorganic, and biological contaminants from process condensate, boiler feed water blowdown, storm runoff, and miscellaneous plant water so that the water could be reused. Sanitary sewage would be treated separately. Effluent treatment would include dissolved air flotation, sludge thickening, conditioning and filtering, water aeration for biodegradation of any organic material, and water clarification. The treated water from the clarifier would then be pumped to other locations for reuse.

Product Pipeline

The upgraded shale oil would be transported to a common carrier pipeline originating in Colorado (as yet unidentified) for transportation to refineries in the midwestern U.S. (See Map R-A-1, located in Appendix R-A.)

The proposed pipeline corridor would be 16.5-miles long and 40-feet wide (maximum width assumed for a "worst-case" situation, although applicant has stated its intent to limit disturbance to 20 feet). A 10-inch diameter pipeline would be used for the initial phase of 16,500 bpsd. Once maximum capacity (57,000 bpsd) is achieved, the 10-inch line would be supplemented by a parallel 12-inch line. A pumping facility would be built on the plant site.

The pipelines would cross the White River about 8 miles east of the plant site. Standard stream crossing construction techniques would be utilized. The exposed portion of pipe at the river crossing would be double cased and protected from vandalism.

An electric monitoring cable would parallel all pipelines and would detect a spill immediately. In the event of a spill, pipeline pumps would be shut down

and the spill location determined. Earth-moving equipment would be rapidly transported to the spill site to erect containment dams. Vacuum trucks would remove the spill liquid, which would then be returned to the plant for cleanup. All oil-contaminated soil would be removed and hauled back to the site for disposal in the spent shale disposal area.

If an oil spill occurred in water, straw and straw bales would be used to contain and absorb the spill. Vacuum trucks would remove spilled liquid from points of accumulation. To minimize stream bank and bottom disturbance, backhoes and/or front-end loaders would be used to remove mixed oil and straw.

Assuming a rupture would occur at the maximum spill point (i.e., where the block valves would be the maximum distance apart or where the driving time to a rupture would be longest), a pipeline could lose a maximum of 2,700 barrels of shale oil in the event of spill or rupture on land. A rupture at almost any point could result in some oil spilling into the White River. Assuming a worst-case spill at the White River crossing (5 minutes for confirmation of rupture and pump shutdown; complete rupture between automatically operated block valves located on each side of a river), 1,000 to 1,200 barrels of oil could be spilled directly into the river.

Spent Shale Disposal

Use of the spent shale area would begin in 1986 and continue through 2014. The spent shale pile would be built in successive stages to minimize fugitive dust emissions and to allow progressive revegetation efforts, which would start about 5 years after startup of the retort operation. Reclamation procedures for the spent shale disposal area are summarized in Appendix R-J.

Spent shale would be moistened to aid compaction and transportation on a conveyor from the retort facility to a truck loadout bin in the disposal area. Trucks would dump the spent shale on the allocated 3,440-acre site.

An initial layer of spent shale would be spread over the pile area and highly compacted to produce a layer impervious to water. Subsequent layers would be spread and partially compacted by the spreaders and dozers on the ground in 50-foot benches. The effective side slope of the disposal site would be 4:1. The pile would be surrounded by a containment pond adequate to capture and evaporate rainfall, thus precluding runoff from reaching public water sources. See Map S-1-1 for the general outline of spent shale areas.

Retention ponds would be used to hold the runoff from a 100-year flood. Pond liners of clay, plastic, or other acceptable material would be constructed so that maximum seepage is 1×10^{-6} centimeters per second or less. Small berms would also be used along the boundary as required to channel the runoff into the catchment ponds.

Some 650 million cubic yards of spent shale would be disposed during the project life. The net effect would be to create a new artificial ridgeline paralleling the natural ridgeline. The new ridgeline would be about 0.5 miles south of the natural ridgeline and about 150 feet higher.

Ancillary Facilities

Access Roads

An existing private company road approximately 0.3 miles long would be widened. During widening of this road, approximately 2 acres would be disturbed (100-foot wide corridor). A permanent road width of 50 feet for 0.3 miles would be maintained for the life of the project, leaving 1 acre which would be reclaimed following construction (3 months).

Water Supply System

Approximately 7,000 acre-feet per year would be required for the maximum production phase. This water would be used for construction, irrigation, municipal (potable) needs, and boiler feed and process water.

The water would be obtained from the proposed White River Dam reservoir, and transported to the plant site via a 6-mile long pipeline. For the initial phase, this pipeline would be 10 inches in diameter. To expand to the maximum phase, the 10-inch line would be supplemented with a parallel 16-inch line. Water would be fed to the pipelines by two intake structures which would be located near the Ignacio bridge. (See Map R-A-1 in Appendix R-A for location of pipelines.)

Maximum production would require a 1,225 horsepower pumping facility to pump 7,000 acre-feet per year. Power to these pumps would be furnished by the existing Moon Lake Rural Electric Association (REA) line which currently services the American Gilsonite pumps. A minimum of 450,000 barrels of storage or five water tanks and water treatment facilities storage tanks would be provided at the plant site.

Power Supply System

Approximately 40.9 megawatts of electricity would be required for the maximum phase. This electricity would be supplied by an on-site utility plant and supplemented with off-site power purchased from the Bonanza Power Plant via a 138-kV line proposed by Bonanza which would cross the project area (Map S-1-1). This line would be part of the Moon Lake REA complex and has been analyzed in another EIS (BLM 1981c).

The utility plant would consist of a steam boiler firing low btu gas from the retort and a steam turbine generator set. The plant would generate electricity as well as provide high pressure steam for the retort process. Air condensors have been specified to minimize water use.

Natural Gas Supply System

About 52 million standard cubic feet per day (scfd) of natural gas would be required for the maximum phase. This natural gas would be used to make hydrogen for the hydrotreater plant and for startup and emergency use.

The natural gas would be purchased from Northwest Pipeline Company. For the initial phase, an 11-mile long, 6-inch diameter pipeline would be built from an existing Northwest Pipeline Company line. For maximum production, this 6-inch line would be supplemented with an 8-inch line. The rights-of-way would be 40-feet wide for construction and would parallel an existing 10-inch diameter high pressure liquid gas pipeline for approximately 5 miles. (See Map S-1-1 for location of the pipelines.)

A small facility containing metering and containment vessels would be required at the tie-in point on Northwest's line, but no pumping stations would be required. The tie-in procedure would follow state and federal regulations.

Solid Waste Disposal System

Solid wastes which would be generated by the project include nonhazardous sludge, lime and calcium sulfate, green coke, dust, and general garbage. Solid wastes generated by construction, mining, retorting, and other operations as well as general garbage would be collected and disposed in the spent shale disposal area. Shale dust and green coke from heavy oil associated with the TOSCO retort unit would be treated as a solid waste and handled in the same manner.

Hazardous Waste Disposal System

There would be no on-site discharge or disposal of any materials classified as hazardous by EPA. Arsenic (as part of a spent catalyst) would be temporarily stored on site in approved containers according to Resource Conservation and Recovery Act (RCRA) regulations. It would be taken by an approved hazardous waste carrier to an appropriate licensed disposal site (which would probably be in the Denver or Salt Lake City area) or would be recycled to the catalyst manufacturer.

Communication System

A telephone communication line would be constructed to the plant site. The line would connect with an existing cable near Bonanza, Utah, and travel 4 miles along the existing American Gilsonite water pipeline to the plant site.

This line would be owned and constructed by the telephone company, so obtaining a right-of-way permit would be the telephone company's responsibility.

S-1.E ALTERNATIVES

S-1.E.1 GREEN RIVER ALTERNATIVE WATER SUPPLY SYSTEM

Under this alternative, Green River water would be purchased directly out of Flaming Gorge Reservoir from the Bureau of Reclamation and released into the Green River. A 28.4-mile long pipeline would be constructed from the Green River to the plant site. The construction right-of-way corridor would be 40 feet in width (maximum potential BLM-approved width assumed for a "worst-case" situation) and travel southeast from the Green River to the Bonanza Power Plant site, paralleling a right-of-way applied for by the power plant (segment 1). From this point, the pipeline would travel south to the plant site. (See Map R-A-2, located in Appendix R-A, for location of this alternative.) For the initial phase, this pipeline would be 12 inches in diameter. To expand to the maximum phase, the 12-inch line would be supplemented by a parallel 20-inch line. Assuming disturbance of the maximum right-of-way width under a "worst-case" situation, total acreage disturbed by construction of this alternative water supply system would be 274 acres, which would be reclaimed following construction.

Water would be fed to the pipelines by a 2,450 horsepower pumping facility for maximum production. No additional pumping facilities would be needed along the 28.4-mile length. Storage of the water at the plant site would be the same as described for the proposed project.

S-1.E.2 DISPOSAL AREA BYPASS ALTERNATIVE

The Disposal Area Bypass Alternative would involve relocating the existing Chevron pipeline and other utilities proposed to parallel this right-of-way in order to avoid the proposed spent shale disposal area. The other proposed utilities that would be in place at the time when this alternative would be necessary (late 1990's) would be the Syntana-Utah 10- and 12-inch product pipelines, the Tosco Sand Wash product pipeline, and the Deseret Generation and Transmission (DG&T) power transmission line. Instead of the lines heading northeast through the shale disposal area, they would be routed north and east around the northern portion of the shale disposal area (Map S-1-1). The proposed relocation route is within 1 mile of the existing Chevron right-of-way and would initially run parallel to the existing right-of-way for the MAPCO natural gas liquids pipeline and the Uintah County road. As a result of the relocation, the length of each of the lines would be increased from 3-mile segments to 3.8-mile segments.

A total of 128 acres would be disturbed and reclaimed in the relocation. This figure does not include the acreage that would be disturbed where the existing lines would be removed or abandoned, because spent shale would cover this area and this disturbance has already been included in the proposed project disturbance figures.

S-1.E.3 MORMON GAP ALTERNATIVE NATURAL GAS PIPELINE

Under this alternative, a 6-inch and 8-inch natural gas pipeline would be constructed as described for the proposed action natural gas supply system (Section S-1.D.2). The first 5 miles would follow the same route as the proposed pipelines; however, at the Colorado state line, the pipelines would continue northeast through Mormon Gap and tie to the existing Northwest Pipeline Company pipeline in Section 7 (Map R-A-2, located in Appendix R-A). The total length of the pipelines would be 11 miles. Construction of each pipeline would disturb 53 acres, which would be reclaimed as described in Appendix R-J.

S-1.E.4 NO-ACTION ALTERNATIVE

The No-Action Alternative would involve the denial of the requested rights-of-way for the water, product, and natural gas pipelines (refer to the No-action Alternative section of the Site-Specific Analyses Introduction of this EIS for additional explanation of the purpose of this alternative). Without these rights-of-way, Syntana-Utah would not be able to develop the proposed project.

ALTERNATIVES-DATA SUMMARY

S-1.F **DATA SUMMARY**

Various aspects of the proposed Syntana-Utah project and alternatives (where applicable) are summarized in the Table S-1-2, Magnitude and Duration of Land Disturbance; Table S-1-3, Personnel Requirements; Table S-1-4, Resources Used and Produced During Operation; Table S-1-5, Total Controlled Emissions; Table S-1-6, Solid and Hazardous Waste Generated During Operation.

TABLE S-1-2

MAGNITUDE AND DURATION OF LAND DISTURBANCE

Component	Length (miles)	Construction Width (feet)	Operation Width (feet)	Maximum Disturbed Acres/Duration[a]	Removed Acres/Duration	Reclaimed Acres
PROPOSED ACTION						
Mine and Plant	NA	NA	NA	610/30 years	380/30 years	230
Spent Shale Disposal Area[b]	NA	NA	NA	3,440/30 years	3,440/30 years	3,400[c]
Product Pipeline (10")	16.5	40	0	80/1 year	0/0	80
Product Pipeline (12")	16.5	40	0	80/1 year	0/0	80
Access Road	.3	100	50	2/3 months	1/30 years	1.0
Water Pipeline (10")	6	40	0	29/1 year	0/0	29
Water Pipeline (16")	6	40	0	29/1 year	0/0	29
Natural Gas Pipeline (6")	11	40	0	53/1 year	0/0	53
Natural Gas Pipeline (8")	11	40	0	53/1 year	0/0	53
Communication System	4	20	0	10/1 year	0/0	10
TOTAL				4,386	3,821	4,005
ALTERNATIVES						
Green River Water Supply System						
Water Pipeline (12")	28.4	40	0	137/1 year	0/0	137
Water Pipeline (20")	28.4	40	0	137/1 year	0/0	137
Disposal Area Bypass						
Existing Chevron Pipeline	3.8	50	20	23/1 year	0/0	23
Tosco Product Pipeline	3.8	50	20	23/1 year	0/0	23
DG&T Transmission Line	3.8	100	20	46/1 year	0/0	46
Syntana-Utah 10" Product Pipeline	3.8	40	20	18/1 year	0/0	18
Syntana-Utah 12" Product Pipeline	3.8	40	20	18/1 year	0/0	18
Mormon Gas Natural Gas Pipeline						
Gas Pipeline (6")	11	40	0	53/1 year	0/0	53
Gas Pipeline (8")	11	40	0	53/1 year	0/0	53

NOTE: NA = not applicable

[a]Maximum disturbed duration equals maximum duration and/or active land use.

[b]Construction camp would lie within the spent shale disposal area.

[c]The spent shale disposal area (3,440 acres) would be reclaimed throughout the life of the project. Initially 500 acres would be disturbed during construction in preparation of disposal areas. Afferwards, 250 acres per year would be continuously disturbed and reclaimed.

TABLE S-1-3

PERSONNEL REQUIREMENTS

Year	Construction	Operation	Total
1983	480	0	480
1984	950	0	950
1985	1,525	205	1,730
1986	190	660	850
1987	125	790	915
1988	700	780	1,480
1989	1,350	910	2,260
1990	150	1,290	1,440
1991	125	1,400	1,525
1992	700	1,400	2,100
1993	1,350	1,525	2,875
1994	65	1,975	2,040
1995-2012	0	2,100	2,100
2013	0	1,275	1,275
2014	0	450	450
2015	0	0	0

Note: Work force numbers are rounded to nearest 5.

TABLE S-1-4

RESOURCES USED OR PRODUCED DURING OPERATION
(Maximum Capacity)

Resource Consumed	Amount	Resource Produced	Amount
Water	7,000 acre-feet/year	Upgraded Shale Oil	57,000 barrels/day
Electricity	40.9 megawatts/day	Sulfur	63 tons/day
Natural Gas	52 million standard cubic feet/day	Ammonia	215 tons/day
Diesel Oil	30,000 gallons/day		
Oil Shale	84,500 tons/day		

TABLE S-1-5

TOTAL CONTROLLED EMISSIONS

Pollutant	Emissions Rate[a] (kilograms per hour)
Total Suspended Particulates	121
Sulfur Oxides	128
Nitrogen Oxides	746
Carbon Monoxide	64
Hydrocarbons	81

[a]During maximum operation of the facility.

TABLE S-1-6

SOLID AND HAZARDOUS WASTE MATERIALS GENERATED DURING OPERATION
(Maximum Production)

Waste Material	Amount Generated (tpsd)
Nonhazardous Sludge	48
Lime and Calcium Sulfate	69
Green Coke	106
Dust from Raw Shale Handling and Secondary Crushing	47
Arsenic (as part of a spent catalyst)	0.2
General Garbage	1
TOTAL	271.2

NOTE: tpsd = tons per stream day.

CHAPTER S-2

SYNTANA-UTAH OIL SHALE PROJECT

COMPARATIVE ANALYSIS OF PROPOSED ACTION AND ALTERNATIVES

The Syntana-Utah Oil Shale Project proposed action and component alternatives are compared in this chapter. Various component alternatives and components of the proposed action can be assembled into a range of complete system alternatives. Table S-2-1 provides a comparative analysis of significant anavoidable quantifiable impacts of the proposed action and the alternatives that would result if the Syntana-Utah project is implemented. Unavoidable adverse impacts listed in the table are negative environmental impacts that would remain despite mitigation efforts. Adverse impacts that are of low significance or of very short duration are not included.

The No-Action Alternative is not included in the comparison. With this alternative, the project would not be constructed and the impacts associated with the proposal or the other alternatives would not occur.

TABLE S-2-1

SUMMARY COMPARISON OF PROPOSED ACTION AND ALTERNATIVES

Environmental Element*	Proposed Action	Green River Alternative Water Supply System	Mormon Gap Alternative Natural Gas Pipeline	Disposal Area Bypass Alternative
Water Resources	7,000 ac-ft/yr reduction in White River (1.4% of avg. ann. flow) and in Green River downstream	7,000 ac-ft/yr flow reduction in Green River (0.15% of the avg. ann. flow)	**	**
Vegetation, Soils, and Reclamation	4,386 ac disturbed of which 381 ac not re-claimed	216 ac more disturbed	**	**
Wildlife	4,386 ac habitat disturbed	216 ac more disturbed habitat 216 ac high value pronghorn antelope range affected	**	**
Agriculture	291 AUMs lost for grazing on rangeland	5 AUMs less grazing	**	**
Visual Resources	880 ac VRM values affected	**	14 ac more VRM Class IV affected	74 ac more VRM Class IV affected
Land Use Plans	20 mi of pipeline outside of BLM plann-ing corridors	14.5 mi more pipe-line outsite BLM plan-ning proposed corridor	3.5 mi less pipe-line outside BLM plan-ning proposed corridor	**

NOTE: Figures are the projected change to baseline due to development of the Syntana-Utah project.

When "more" or "less" appears in description of the alternative impacts, impacts are being compared to comparable components or processes of the proposed action.

ac = acres; ac-ft/yr = acre feet per year; AUMs = animal unit months; mi = miles; VRM = Visual Resource Management.

*Only those elements that have impacts that very significantly from the proposed action are shown.

**Where no entry is made for an alternative, the impact would not vary significantly from that of the proposed action.

The affected environment for the Syntana-Utah Oil Shale Project (Syntana-Utah) is that part of the existing environment that would be affected by the proposed action (including all project components identified in Chapter S-1) or alternatives. The effects of the project components and the construction and operation work forces on the environment were analyzed for the same resources as identified for the regional analysis (Chapter R-3, Introduction). This chapter provides information only about the environment that would be significantly affected by the Syntana-Utah project as determined by the impact analyses presented in Chapter S-4. Analysis indicated several resources would not be significantly affected by the Syntana-Utah project. Therefore, descriptions of the following resources were not included:

- Paleontology
- Wilderness - no Wilderness Areas or any areas under formal wilderness review, study, or appeal would be directly or indirectly affected by the Syntana-Utah project.

S-3.A PROPOSED ACTION

S-3.A.1 SOCIOECONOMICS

The Syntana-Utah project would cause impacts to Uintah and Duchesne counties in Utah. The Colorado area would experience a very small proportion of impacts. Due to the proximity of the project to the Uintah and Ouray Indian Reservation the Ute Tribe would experience a small proportion of impacts. The communities of Vernal and Roosevelt would experience most of the impacts. A description of the existing and future baseline environment for these areas, including the Uintah and Ouray Indian Reservation, can be found in Section R-3.A.1, Socioeconomics.

S-3.A.2 AIR QUALITY

The Syntana-Utah project would be located just north of the White River at approximately 5,800 feet mean sea level (MSL). Drainage winds are to the south and east into the White River Canyon. Estimated baseline pollutant concentrations are shown in Table S-4-2 (Section S-4.A.2), which shows that no National Ambient Air Quality Standards (NAAQS) violations are expected, with the possible exception of total suspended particulates. The high particulates concentrations expected result primarily from dust due to traffic on unpaved roads and soil particles suspended during windy conditions. Visibility measurements taken at Dinosaur National Monument are presented in Section R-3.A.2, Air Quality.

S-3.A.3 WATER RESOURCES

The surface water, floodplains, and ground water that would be affected by the Syntana-Utah project are described in Section R-3.A.3, Water Resources.

S-3.A.4 VEGETATION, SOILS, AND RECLAMATION

The proposed project would be located in a setting with an average annual precipitation of 5 to 10 inches and an average frost-free season of 110 to 125 days. Vegetative cover on the project area is the mixed-desert shrub type, with total ground cover ranging from barren to 25 percent. For a description of plant communities, vegetative types, and species composition, refer to Section R-3.A.4, Vegetation and Soils. The geographic location of vegetative types and plant communities are shown on Figure R-3-1 in that section.

Soils are mainly shallow to moderately deep, moderately to strongly alkaline, loamy, upland soils with thin surface layers, low inherent fertility, and contain varying amounts of rock fragments. They are on sloping to moderately steep convex ridges and sideslopes. The deeper soils are in concave drainageways. Rock outcrop areas are common on the steeper sloping ridges.

Native perennial vegetative cover is difficult to reestablish due to low precipitation, variable and unfavorable soil properties, and slope.

S-3.A.5 WILDLIFE

Habitat Types

The primary wildlife habitat type occurring on the project area is desert-shrub (see Section R-3.A.4, Vegetation and Soils, for description of this type).

Terrestrial Wildlife

The entire project area is located in mule deer range. The lease area is comprised of approximately 3,776 acres of low priority, year-long deer range with approximately 3,584 acres of high priority deer winter range also involved. Numbers of deer utilizing this area are not known at this time.

The lease area and all of the various product lines, power transmission lines, and access roads are located on high priority year-long pronghorn range (UDWR 1981). Aerial trend counts in the Bonanza hunt area in April 1982 indicate about 295 pronghorns antelope occupy this general area (Crannie 1982).

The only game bird of any consequence found on or near the project area is the mourning dove. The chukar partridge was introduced into the area many years ago but appears to be almost extinct. In the near future, the Utah Division of Wildlife Resources plans to reintroduce this bird into favorable habitat

within the area. Some waterfowl resting habitat is found on the White River, but little nesting habitat is available.

Raptors common to the project area include red-tailed hawks, golden eagles, prairie falcons, marsh hawks, and American kestrels. The shallow, sage-covered draws in this area furnish nesting habitat for marsh hawks, while the riparian zone along the White River furnishes many tree nesting sites for other species of raptors. However, the entire area is hunting habitat for all species of raptorial birds. Bald eagles are known to concentrate along the White River during the winter months, and some known winter roost trees are found within the general area of the project site.

The species of nongame mammals, nongame birds, and reptiles and amphibians that could be found on the project area are similar to those found throughout the Uintah Basin. Refer to Section R-3.A.5, Wildlife, for a discussion of these species.

Threatened or Endangered Species

The U.S. Fish and Wildlife Service indicates several federally listed species could occur on the project area (Table R-3-11 and Appendix R-K). Three endangered fish species have been found in the White River--the Colorado squawfish (Ptychocheilus lucius), the humpback chub (Gila cypha), and the bonytail chub (Gila elegans).

S-3.A.6 AGRICULTURE

Cropland

There is no cropland located within the lease area or within any of the facility corridors of the proposed action. Cropland, including prime agricultural land, in the Ashley Valley-Jensen and Rangely areas would be affected by land use conversion for homesites and related urban development to accommodate the anticipated increase in population from the Syntana-Utah project. For a description of the cropland that would be affected, refer to Section R-3.A.6, Agriculture.

Grazing

Livestock grazing is authorized on all lands that would be occupied by the project. The BLM has established grazing allotments that include private and state lands which are administered under an Exchange-of-Use Agreement by the BLM. Elements of the proposed action would cross six BLM grazing allotments containing 19,500 AUMs of forage that would support approximately 3,900 head of cattle.

S-3.A.7 TRANSPORTATION NETWORKS

The transportation networks that would be affected by the Syntana-Utah project are described in Section R-3.A.7, Transportation Networks.

S-3.A.8 RECREATION

There are no developed outdoor recreation facilities or intensively used outdoor recreation use areas at the Syntana-Utah project area. The types and amount of this type of recreation use occurring in Uintah County, which includes this project area, is provided in Section R-3.A.8, Recreation.

Within the Syntana-Utah project area, dispersed recreational opportunities are limited. Hunting is considered limited for small game. However, deer and antelope hunting occurs along the canyon bottom of the White River. An unquantified amount of fishing, primarily for channel catfish, also occurs in the White River. Small and big game hunting and fishing statistics for Uintah County between 1976 and 1980 are presented in Table R-3-13.

A small, unquantifed amount of off-road vehicle (ORV) use also occurs within the project area. Other forms of dispersed recreation including camping, sightseeing, and hiking are generally limited within the project area due to low quality experiences associated with these recreation opportunities.

Recreational activities enjoyed on the White River include fishing, canoeing, and rafting. As described in Section R-3.A.8, Recreation, the White River is on the Nationwide Rivers Inventory, Phase I list (HCRS 1981). It is assumed that recreation activities associated with the White River reservoir would replace some of the existing river recreation.

Municipal and county recreation facilities that could be affected by implementation of this project are described in Section R-3.A.8, Recreation.

S-3.A.9 CULTURAL RESOURCES

Prehistory

The Syntana-Utah project lies within the Uintah Basin of the Colorado Plateau, as described in Section R-3.A.10, Cultural Resources. A portion of the Syntana-Utah project, located in Sections 2 and 16, S1/2 Section 15, SW1/4 Section 14, N1/2 Section 22, and N1/2 NW1/4 23, T.9S., R.25E., was surveyed by Nickens and Associates (1981). Four prehistoric isolated finds were located. Two were individual projectile points, probably of the Archaic period. None of the isolated finds were considered significant for listing on the National Register of Historic Places (Steel 1981).

History

The general history of the Syntana-Utah project area is contained in Section R-3.A.10 Cultural Resources. One historic site and four historic isolated finds were located on the Syntana-Utah project area during the survey by Nickens and Associates. Site 42 UN 949 is associated with gilsonite mining around the turn of the century and is considered eligible for nomination to the National Register of Historic Places. The site probably served as living quarters for prospectors and was abandoned before 1920. A gilsonite trench adjacent to the site was probably mined at a later date (Steel 1981).

S-3.A.10 VISUAL RESOURCES

The proposed project would be developed within the Colorado Plateau physiographic province. The local landform is mostly a desert plateau with low rolling hills and occasional deep drainage patterns segmented by the White River. Vegetation consists of mixed-desert shrub with interspersed riparian zones. The area is generally uninhabitated except for the small community of Bonanza, but it contains a high degree of cultural modification through the presence of gilsonite mining activities, numerous roads, and projects under construction.

The project area consists of two Visual Resource Management (VRM) classes. Class II extends along the White River for approximately 1-mile on either side of the river. The remainder of the project area is categorized as VRM Class IV (BLM 1979a). Refer to Appendix R-H, Visual Resource Management Methodologies, for an explanation of VRM classes.

The project would affect the existing visual environment from two areas. The area is generally seen from a highly sensitive area along the White River and is viewed also from the county road which crosses through the area. Approximately 50 acres of VRM Class II areas would be affected and 830 acres of VRM Class IV areas would be affected by the proposed action. Refer to Section R-4.A.11, Visual Resources, for explanation of the methodology used to determine areas in which the visual resources would be affected.

Existing visibility conditions are discussed in Section S-4.A.2, Air Quality.

S-3.A.11 MINERAL AND ENERGY RESOURCES

The mineral and energy resources underlying the 8,648-acre project area are similar to those found throughout the Uintah Basin. These resources are identified in Section R-3.A.13, Minerals and Energy Resources.

S-3.A.12 EXISTING LAND USE PLANS

The land use constraints for the Syntana-Utah project are summarized in Section R-3.A.14, Existing Land Use Plans.

S-3.B ALTERNATIVES

The affected environment for the alternatives to Syntana-Utah's proposed action would be similar to that described for the proposed action (Section S-3.A). The acres of land that would be affected by the alternatives are identified on Table S-1-2 (Section S-1.F). The Green River water and recreation environments are described in Sections R-3.A.2 and R-3.A.8, respectively.

The environmental consequences are those impacts resulting from implementing the proposed action or any of the alternatives. In this chapter, impacts are discussed in a level of detail that corresponds to the severity of impact. Thus, the most significant impacts are discussed in the most detail. The following resources would not be significantly affected by the proposed action or alternatives and, therefore, are not discussed further.

- Paleontology
- Wilderness - no Wilderness Area(s) or any area under formal wilderness review, study, or appeal would be directly or indirectly affected by the proposed action or alternatives.

S-4.A **PROPOSED ACTION**

S-4.A.1 SOCIOECONOMICS

The total population increase in Uintah and Duchesne counties and the Colorado area would be 3,249 persons in 1985 and 8,131 in 1995.

Uintah County would be the major area affected. The Colorado area would experience very small impacts with a 2.0 percent (521 persons) increase over baseline in 1995. Duchesne County also would experience minimal growth with a 6.1 percent (1,125 persons) increase over baseline in 1995. Uintah County's population increase over baseline would be 10.3 percent (2,654 persons) in 1985 and 21.5 percent (6,435 persons) in 1995.

Vernal would be the community most affected with population increase over baseline of 8.7 percent (806 persons) in 1985 and 27.9 percent (3,172 persons) in 1995. Roosevelt would have a substantial increase in 1995 at 11.3 percent (670 persons) over baseline. In comparison to baseline, Dinosaur would have the greatest population impact with a percentage increase above baseline of 15.2 percent (97 persons) in 1985 and 59.1 percent (320 persons) in 1995.

Though the Syntana-Utah project would be very close to the Colorado area, it was assumed that the poor condition of the road between Bonanza and the Colorado state line and Uintah County's non-maintenance policy for roads would preclude commuter travel on the road. Thus, it was assumed that the travel way to Rangely would be the Bonanza road to SR 40 to SR 64. This, in turn, reduced the population allocations to the Colorado area. (Barber 1982)

Employment benefits would center in Uintah County, which would have increase above baseline of 19.3 percent (2,042 persons) in 1985 and 29.1 percent (3.217 persons) in 1995. Duchesne County and the Colorado area would have relatively small employment growth.

Housing

In terms of households, Uintah County would have the most housing demand growth, while Vernal would have the largest increase at the community level. Uintah County's major impacts would occur in 1995 when housing demand would be 20.9 percent (1,792 households). Vernal's increase in that same year would be 24.4 percent (883 households). Dinosaur in 1995, would have the greatest increase over its baseline, 49.0 percent (70 households).

Such housing demands would create a short-term under-supply of housing and would, therefore, result in increased temporary housing such as mobile home parks. The extreme shortages in housing would also likely increase the existing problems of squatters on public lands.

Personal Income

Personal income which would be produced by the Syntana-Utah project is estimated at $67.4 million (1980 dollars) in 1985 and $107.3 million in 1995.

Government Services and Facilities

The majority of impacts on education would be felt in 1995. Uintah County would be the most affected with an increase in 1995 for additional teachers and classrooms of 70. This is a 19.1 percent above projected baseline demand and would require expansion in classroom space.

In 1995, Uintah County would require 13 or 21.6 percent additional hospital beds over baseline demand. In addition, 4 or 15.4 percent more physicians and 13 or 16.0 percent more nurses would be needed. Duchesne County would have minor increased health needs as would the Colorado area.

Mental health services would have to be increased by a very small amount as a result of the Syntana-Utah project. One social worker above baseline would be needed.

For Uintah County, the major county affected, there would be a demand for 6 additional police officers and 1 additional patrol car over baseline 1995 due to the Syntana-Utah project.

Vernal would incur the largest increase in demand for sewer services, with a 27.9 percent increase over baseline in 1995. Vernal could handle this growth if the planned sewer system expansion is completed on schedule. The much smaller increases to Roosevelt's system could be handled by the existing sewer system.

Vernal would have the greatest water demand increase as a result of the Syntana-Utah project. By 1995, demand for water connections could reach 27.9 percent above baseline. This could not be absorbed by the existing water system, but could be if the new proposed water system is built.

Quality of Life

The local social effects projected to occur if this project is implemented would be centered in Uintah County, with low-level effects expected in the Roosevelt area as well. The changes in Uintah County would be similar to those described under the regional high-level scenario (Section R-4.A.1, Socioeconomics) but at a much lesser scale and intensity.

Uintah and Ouray Indian Reservation

The Syntana-Utah project would be located about 75 miles (by road) from the reservation boundary. No facilities are proposed to cross the reservation. However, some primary and secondary effects could be felt by the Ute Tribe. These would be similar to those discussed in Section R-4.A.1, Socioeconomics. The magnitude of these impacts would be less, however, due to the detachment of the project from the reservation.

S-4.A.2 AIR QUALITY

As shown in Table S-4-1, increased total suspended particulate and sulfur dioxide concentrations would be within the prevention of significant deterioration (PSD) incremental limitations. Total pollutant concentrations would be within the National Ambient Air Quality Standards (NAAQS), as shown in Table S-4-2, with the possible exception of the 24-hour standard for total suspended particulates for which baseline levels may already exceed the standard due to dust from unpaved roads and wind-raised soil particles. The concentration from the Syntana-Utah project would exacerbate the existing high particulate concentrations.

The potential for atmospheric discoloration at Dinosaur National Monument and the Uintah and Ouray Indian Reservation were calculated. The results predicted that a faintly visible yellow-brown atmospheric discoloration resulting from Syntana-Utah emissions of nitrogen oxides would be observed at the Dinosaur Visitors Center from 3 to 50 mornings per year and 0 to 14 afternoons per year, depending on the sensitivity of the observer. A faintly visible yellow-brown discoloration would be visible an estimated 0 to 26 mornings and 1 to 16 afternoons per year at the Uintah and Ouray Indian Reservation. The discoloration could also be visible in the vicinity of the facility during some conditions, especially clear, stable mornings with light winds.

An EPA level-1 visibility screening test (see Appendix R-G) indicated that a whitish particulate plume could be visible against dark terrain at Dinosaur National Monument under certain meteorological conditions (generally mornings with stable, light wind speed flow toward Dinosaur). The test also predicted that impacts to visibility at all other potential or existing Class I areas would not be significant, based on significance criteria given in Chapter R-4. For additional information on the visibility analysis, refer to Appendix R-G or the Air Quality Technical Report (Systems Applications Inc. 1982).

TABLE S-4-1

COMPARISON OF MAXIMUM INCREASED POLLUTANT CONCENTRATIONS WITH PSD INCREMENTAL LIMITATIONS

	SO_2 Concentration[a] (ug/m^3)			TSP Concentration[b] (ug/m^3)	
PSD Increments/Increment Consumption	3-Hour Average	24-Hour Average	Annual Average	24-Hour Average	Annual Average
Class II Areas					
Allowable PSD Class II increment	512	91	20	37	19
Syntana-Utah increment consumption	41	8	1	13	1
Increment consumption incuding baseline	44	8	1	13	1
Syntana-Utah increment consumption at Uintah and Ouray Indian Reservation	8	1	0	less than 13	less than 0
Increment consumption at Uintah and Ouray Indian Reservation including baseline	14	2	0	less than 14	less than 0
Class I Areas					
Allowable PSD Class I increment	25	5	2	10	5
Increment consumption at Flat Tops Wilderness Area (federal Class I)					
Syntana-Utah increment consumption	0	0	0	0	0
Increment consumption including baseline	0	0	0	0	0
Increment consumption at Maroon Bells-Snowmass Wilderness Area (rederal Class I)					
Syntana-Utah increment consumption	0	0	0	0	0
Increment consumption including baseline	0	0	0	0	0
Increment consumption at Dinosaur National Monument (Colorado Category I and potential federal Class II)					
Syntana-Utah increment consumption	1	0	0	0	0
Increment consumption including baseline	3	0	0	0	0

TABLE S-4-1 (Concluded)

COMPARISON OF MAXIMUM INCREASED POLLUTANT CONCENTRATIONS WITH PSD INCREMENTAL LIMITATIONS

PSD Increments/Increment Consumption	SO_2 Concentration[a] (ug/m^3) 3-Hour Average	24-Hour Average	Annual Average	TSP Concentration[b] (ug/m^3) 24-Hour Average	Annual Average
Increment consumption at Colorado National Monument (Colorado Category I and potential federal Class II)					
Syntana-Utah increment consumption	0	0	0	0	0
Increment consumption incuding baseline	0	0	0	0	0

Note: For more information on the models used in this analysis, refer to Appendix R-G.

SO_2 = sulfur dioxide; TSP = total suspended particulates; ug/m^3 = micrograms per cubic meter.

[a]Calculated using SAI Gaussian Puff Model with 5-kilometer grid spacing.

[b]Class II increment calculated using EPA Complex I Model with 1-kilometer grid spacing. Class I consumption calculated using SAI Gaussian Puff Model with 5-kilometer grid spacing.

TABLE S-4-2

COMPARISON OF MAXIMUM GROUND-LEVEL POLLUTANT CONCENTRATIONS WITH THE NATIONAL AMBIENT AIR QUALITY STANDARDS (NAAQS)

Pollutant / Averaging Time	Maximum Ground-Level Concentration (ug/m^3)			
	Baseline and Other Sources[a]	Source Impact[b]	Total[c]	NAAQS (ug/m^3)
Sulfur dioxide (SO_2)				
3-Hour	2	41	43	1,300
24-Hour	1	8	9	365
Annual	0	1	1	808
Total suspended particulate (TSP)				
24-Hour	153	13	166	150
Annual	39	1	40	60
Nitrogen dioxide (NO_2)				
Annual	1	6	7	100
Carbon monoxide (CO)				
1-Hour	200	20	220	40,000
8-Hour	200	20	220	10,000
Ozone (O_3)				
1-Hour	70	2	72	240
Hydrocarbons (HC)				
3-Hour	100	26	126	160

Note: For more information on the models used in this analysis, refer to Appendix R-G.

ug/m^3 = micrograms per cubic meter.

[a]CO, HC, and O_3 estimated from air quality monitoring data; SO_2 and NO_2 estimated from dispersion modeling; TSP estimated from Empirical Model.

[b]Calculated using the SAI Gaussian Puff Model with 5-kilometer grid spacing, expect TSP concentrations, which were calculated using the EPA Complex I Model with 1-kilometer grid spacing.

[c]It is conservatively assumed that baseline maximum coincides with Syntana-Utah maximum.

S-4.A.3 WATER RESOURCES

Surface Water

The Syntana-Utah operation would be a zero discharge process; therefore, the processing facilities would not alter the quality of any surface water supply. However, erosion caused from construction would contribute additional sediment to streams. This would be a temporary and insignificant impact. The 7,000 ac-ft/yr of water that Syntana-Utah proposes to withdraw from the White River represents 1.4 percent of the average annual flow. Withdrawal of this amount would not represent a significant impact.

Floodplains

Impacts to floodplains are discussed in Section R-4.A.3, Water Resources.

Ground Water

The mine shafts may encounter a more permeable zone of the Bird's Nest aquifer and would require dewatering during construction. The effect would be temporary and probably would not extend to the boundaries of the mine property. The mine, which would be located below the Bird's Nest, might encounter a large open fracture or fracture zone extending to the Bird's Nest aquifer. Any water entering the mine would be used to augment the water supply.

S-4.A.4 VEGETATION, SOILS AND RECLAMATION

The acreages of vegetation and soils that would be disturbed during construction and operation of the proposed project and alternatives are summarized in Table S-4-3. Native vegetation would be removed during construction of plant and surface facilities with the result that 3,816 acres would be removed from production for the life of the project (30 years). Temporary disturbance on 544.6 acres of soils and vegetation would occur during the construction of rights-of-way for pipelines, power transmission lines, and access roads, as well as in areas adjacent to buildings and spent shale piles.

Understory vegetation is expected to return to near preconstruction densities, which range from 0 to 25 percent, within 3 to 10 years after implementing reclamation measures; however, it would require up to 20 years for brush species to attain preconstruction dimensions and densities. Therefore, with successful implementation of the proposed reclamation plan, impacts to vegetation cover would be considered insignificant. Should climatic conditions prevent successful seedling establishment which would favor the invasion of noxious weeds, the impact to vegetation would become significant in the disturbed area. Secondary impacts occurring outside the project area, such as the crushing and uprooting of vegetation caused by the anticipated increase in off-road vehicle usage, cannot be quantified at this time but could become significant as the population increases (Table S-1-3).

No threatened or endangered plant species are known to exist in the project area or along other utility corridors.

TABLE S-4-3

SUMMARY OF SURFACE AREA DISTURBED, OCCUPIED, RECLAIMED, AND GRAZING AND CROPLAND AFFECTED BY PROJECT COMPONENT

Project Components	Area Disturbed (Total) Miles	Area Disturbed (Total) Acres	Area Occupied (Project Life) Acres	Area Reclaimed and Revegetated Acres[a]	Potential Grazing Losses[b] AUMs[c]	Potential Grazing Losses[b] Livestock Numbers[d]	Cropland Affected Acres	Prime Agricultural Land Affected Acres
Proposed Action:								
Plant Site and Related Facilities[e]	NA	595	376	220	40	13	0	0
Spent Shale Disposal Area	NA	3,440[f]	3,440	3,440[g]	229	76	0	0
Access Roads	0.3	2	1	1	0	0	0	0
Water Pipelines[h] (White River)	6.0	58	0	58	4	1	0	0
Natural Gas Pipelines[i]	11.0	106	0	106	7	2	0	0
Product Pipelines[j]	16.5	160	0	160	11	4	0	0
Off-Site Urban[k] Development	NA	NA	NA	NA	NA	NA	1,789	537
Total		4,359	3,817	3,985	291	96	1,789	537
Alternatives:								
Green River Water Supply System	28.4	274	0	274	9	2	0	0
Disposal Area Bypass	3.8	128	0	128	8	2	0	0
Mormon Gap Natural Gas Pipeline	11	106	0	106	7	2	0	0

[a]Considered temporary disturbance with exception of spent shale disposal area. Would occur unless the right-of-way would be fenced.

[b]Grazing losses would occur if grazing leases would be reduced or cancelled by the land managing agency.

[c]AUMs computed as an average of 15 acres AUM for all land ownerships (USDI 1981).

[d]Livestock numbers are based upon a 3-month grazing season. One unit = 1 cow or 1 horse or 5 sheep (BLM grazing records, Vernal, Utah 1981).

[e]Includes raw shale and spent shale disposal areas, conveyers (with accompanying maintenance roads), retort facilities and associated mine shafts.

[f]Disturbance would consist of surface soil removal for use in reclamation of spent shale disposal area.

[g]Reclamation of spent shale would be conducted concurrently with operations and would be protected from grazing during project life; not considered temporary disturbance.

[h]Two pipelines are proposed for construction. Each would disturb 29 acres.

[i]Two pipelines are proposed for construction. Each would disturb 53 acres.

[j]Right-of-way acreage is 79 acres, however two pipelines are proposed at different construction periods, resulting in double land disturbance.

[k]Cropland converted to urban uses due to project-related population increase in the Ashley Valley-Jensen area.

Soil loss resulting from accelerated wind and water erosion caused by construction of the linear corridor facilities would occur until erosion control measures are implemented (1 year). Impacts to soils would be considered generally temporary and minimal. Soil loss is expected to be minimized with implementation of the erosion control and revegetation procedures outlined by Syntana-Utah (Appendix R-J). However, impacts to soils would be significant if applicable erosion control measures are not implemented due to lack of compliance with approved plans and if adverse weather conditions (mainly heavy rainstorms) would occur during construction before any erosion control measures could be installed. A few small unquantifiable areas (mainly abrupt steep slopes along the facility rights-of-way) would require continuing follow-up measures.

The spent shale disposal area would disturb 3,440 acres. This disturbance would occur concurrently with project operations, and the acreage would be removed from production for the life of the project. This disposal area would be reclaimed in stages concurrently with project operations. Spent shale would not support plant growth without treatment because of its physical and chemical properties. The surface of the spent shale area would be shaped, stabilized, and made suitable for plant growth by reclamation measures and procedures outlined by the Syntana-Utah reclamation program (Appendix R-J). Covering the spent shale with topsoil and soil materials suitable for plant growth would minimize the problems of making the spent shale surface suitable for revegetation. Refer to Appendix R-J and Section R-4.A.4, Vegetation, Soils, and Reclamation, for more detailed discussion concerning availability, placement and maintenance of soil materials suitable for plant growth on the spent shale disposal area reclamation. Reclamation and erosion control is expected to be successful with intensive implementation of the applicable measures outlined by Syntana-Utah and from the demonstrated results of current field studies.

S-4.A.5 WILDLIFE

Habitat

This project would result in both indirect and direct losses of wildlife habitat. Direct losses of habitat as a result of project development would total an estimated 4,386 acres; 4,050 acres on the lease area, 336 acres on rights-of-way (Table S-4-3). Of these direct habitat losses, an estimated 3,821 acres would be lost for the life of the project (30 years). Other direct losses of habitat include those areas that are not physically destroyed or modified but are near to project facilities and would become temporarily unusable by wildlife because of isolation, dust, noise, and so forth. At this time, the numbers of acres lost because of isolation and similar factors etc., cannot be estimated reliably because each animal species has its own level of tolerance and these data are not available with present levels of knowledge. The long-term loss of an estimated 3,821 acres would total less than 1 percent of the available habitat in this area. Impacts to vegetative habitats from peak construction (1985) and peak operation (1995) work forces would be approximately the same. No additional impacts to wildlife are anticipated between the two periods. See Table R-4-20 for the types of habitat lost by different wildlife species. These losses would effect wildlife populations as discussed below.

PROPOSED ACTION-WILDLIFE

Wildlife Populations

Wildlife populations within the project area could be lost or reduced with the development of this project. These losses probably would increase as the project work force increased because of larger numbers of work-related personnel using the wildlife resources of the area. Losses of animals could be directly caused by project construction and operation or indirectly caused by poaching, wanton killing, collecting, and similar activities.

The loss and disturbance of high priority deer winter range located within the project area could cause population reductions because of harassment and displacement. Harassment of mule deer on their winter ranges could cause a reduction in reproduction because of stress to the animals. Stressful situations could cause abortions and/or could result in deaths of adult deer (Geist 1974). In addition, deer could be displaced into less favorable areas during the critical November 1 through May 15 period. These less favorable areas may not have essential habitat components, thus causing more stress to wintering mule deer.

The permanent loss of about 3,816 acres of high priority deer winter range in this area (Table S-4-4) amounts to less than 1 percent of this class of deer winter range found north of the White River (UDWR 1981a). About 4,386 acres of all types of deer range habitat would be lost because of Syntana-Utah project development.

The loss of high priority value year-long pronghorn range for the life of the project is about 1 percent of the high priority pronghorn range available in this area (based upon wildlife habitat and distribution maps furnished by the Utah Division of Wildlife Resources (1981a)).

Topsoil removal and storage for later reclamation, ancillary facility construction and access road upgrading would cause direct mortality to the small mammal population on the project area. Losses on an estimated 3,816 acres would be heavy, but because of the high reproductive potential of these species, repopulation of reclaimed areas would be rapid. However, revegetating the disturbed areas to grass rather than desert-shrub type could result in different small mammal populations, since small rodents that frequent shrub habitat might not return to a reclaimed area planted to grass (BLM 1978c).

Mourning doves feed and nest on most of the proposed site, but habitat is marginal because of the uniformly poor quality of habitat throughout the area. No data exist on nesting dove populations. This loss of habitat (Table S-4-4) with its estimated production would be less than 1 percent of the Uintah County dove population.

Some small nongame songbirds would be lost or displaced by the permanent loss of their habitat for the life of the project. The best available bird population density estimates average 21 breeding pairs per 100 acres in this area. It is anticipated that these losses would be less than 1 percent of the Uintah County population.

TABLE S-4-4

WILDLIFE HABITAT LOSSES

Species	Long-term Losses[1]	Short-term Losses[2]
Mule Deer	3,821 acres total 3,816 acres high priority winter range 5 acres limited value yearlong range	565 acres total 504 acres high priority winter range 61 acres limited value yearlong range
Pronghorn	3,821 acres total 3,821 acres high priority yearlong range	565 acres total 565 acres high priority yearlong range
Small Mammals	3,821 acres total	565 acres total
Mourning Doves	3,821 acres poor quality nesting and feeded habitat	565 acres poor quality nesting and feeded habitat
Nongame Songbirds	Same as mourning dove	Same as mourning dove
Raptors	3,821 acres of prey habitat, some unquantifiable nesting habitat	565 acres of prey habitat, some unquantifiable nesting habitat
Reptiles	3,821 acres	565 acres

Note: The description of the various wildlife range types are found in UDWR 1981a.

[1]Long-term = the life of the Syntana-Utah project (30 years).

[2]Short-term = 3 to 5 years (initial reclamation period).

Raptors could be adversely affected by this project because of the elimination of about 3,816 acres of prey habitat. Some nesting habitat for ground nesting raptors such as marsh hawks and ferruginous hawks would also be lost for the life of the project. Raptor losses are not expected to be significant,

however, as there appears to be ample nesting and foraging habitat throughout the areas adjacent to the project.

There are two known active golden eagle eyries along the White River adjacent to the project area. Disturbance of these nests by construction and maintenance personnel during the critical nesting period of March 15 through July 15 would cause the adult birds to abandon the nests resulting in a loss of production for that year. Harassment of nesting golden eagles is prohibited by the Bald Eagle Protection Act of 1940, as amended.

Removal of reptile habitat (Table S-4-4) for the life of the project would result in direct losses or displacement. This would equal less than 1 percent of the regional population of these animals. Species reproduction is high, so repopulation would be rapid once the project has been completed. The small amount of riparian habitat disturbed by this project would have no adverse effect upon amphibian populations in the area.

Threatened or Endangered Species

The average annual withdrawal of about 7,000 ac-ft/yr of water from the White River for operation of the Syntana-Utah project is an estimated 1.4 percent of the average annual flow. It is the opinion of the U.S. Fish and Wildlife Service that any reduction in flow in the White River would have an adverse effect upon endangered fish species (FWS 1982). Therefore, Section 7 consultation with the U.S. Fish and Wildlife Service on the water withdrawal is in process. In addition, purchase of water from the White River Dam by Syntana-Utah is covered by conservation measures already agreed to by the State of Utah under the biological opinion rendered on the White River Dam Project in 1982. In addition, withdrawal of water via a diversion structure in the river would cause losses by impingement of young and adult fish when water is being withdrawn.

S-4.A.6 AGRICULTURE

Cropland

Anticipated population increases and their associated support facilities would cause significant land use conversion of cropland to other uses in the nearby population areas of the Ashley Valley-Jensen and Rangely areas. An estimated 7,789 acres of cropland, including prime agriculture land, would be converted to homesites and related urban developments resulting from population increases due to the Syntana-Utah project (Table S-4-3, Section S-4.A.4). This land use conversion would contribute to the loss of cropland in the region, a discussed in Section R-4.A.6, Agriculture.

No agriculture cropland would be affected within the lease area or within any of the facility corridors of the proposed action or alternatives.

Grazing

The proposed action would remove 3,816 acres of vegetation and its production capacity for the life of the project (30 years) in areas where there are surface structures and spent shale piles. With successful reclamation procedures, it would take 1 to 5 years after project abandonment to reclaim these areas to preconstruction conditions. Where construction of linear rights-of-way would disturb 544.6 acres of vegetation, productive capacity would be restored to preconstruction levels within 1 to 5 years after implementation of the reclamation plans outlined by the applicant (Appendix R-J).

Loss of forage from the project would total approximately 291 AUMs annually (Table S-4-3, Section S-4.A.4) or 1.5 percent of the carrying capacity for the allotments within the project area. One allotment where plant and spent shale areas are located would sustain a loss of 254 AUMs or 7.5 percent of that allotment's carrying capacity. Since more than 10 AUMs would be lost in this allotment, impacts from forage losses would be significant, and a reduction in allowable use would be made.

Secondary impacts from livestock road kill and disruption of traditional grazing patterns could be significant. These secondary impacts could cause a loss of marketable pounds of red meat when combined with the forage loss.

S-4.A.7 TRANSPORTATION NETWORKS

Traffic projections prepared for the Syntana-Utah project indicate a considerable amount of traffic on new County Road "A." By 1995, approximately 2,300 vehicles per day would be using this road. The primary destination for these trips would be Vernal. By 1995 U.S. 40 from the county line to County Road 264 and from Vernal to Jensen would experience an unacceptable level of service. The level of service would be reduced to Level D (American Association of State Highway and Transportation Officials 1965). This means traffic flow would fluctuate in volume and would have temporary restrictions to flow, which could cause substantial drops in operating speeds. The Mormon Gap road would also be used heavily while it is passable, and therefore would be subject to declines in level of service. The projected traffic volume and level of service analysis for the network is presented in the Socioeconomics Technical Report (State of Utah 1982b).

Most of the truck traffic generated by Syntana-Utah would be transporting sulfur, ammonia and supplies to the site. This is estimated to be 2 trips per day to Vernal and 2 trips per day to Craig, Colorado. Construction activities would also generate additional heavy truck trips. These would probably come in caravans, hauling heavy equipment to the site.

S-4.A.8 RECREATION

Implementation of the proposed Syntana-Utah project would directly disturb over the life of the project 4,386 acres of land available for dispersed

recreation use. This loss of available land for recreation use would be caused by the construction of plant, mine, and shale disposal facilities.

Because of the hazards associated with the project, it is unlikely that public recreation use would be allowed in the area to be developed once operations are started. The amount of recreation use that this loss of available area would eliminate is undeterminable, since use records are not available. The use presently occurring in the region, of which the Syntana-Utah project area is a part of, is described in Section R-3.A.8, Recreation.

Construction of the right-of-way facilities (power transmission line, water pipeline, product pipeline, and access road) would have only a temporary impact (1 to 5 years) on recreation user values. The initial impact of these facilities would occur by 1985 (peak construction). Construction of these facilities would not remove any area which is currently available for recreation use. Visual aspects for the recreation users would be affected (Section S-4.A.11, Visual Resources).

The section of the White River from the confluence of the Green River to the Colorado-Utah state line has been identified by the Nationwide Rivers Inventory, Phase I (HCRS 1981a, 1981b). The proposed water diversion facilities could cause adverse aesthetic impacts on the "natural, cultural, and recreation values" of the White River (Federal Register 1980a). However, since this EIS includes the assumption that the White River Dam would be constructed, and since the proposed action for the Syntana-Utah project would be to pump water directly from the White River reservoir, the prior impacts of the White River Dam Project would likely eliminate the river from any future consideration as a National Wild and Scenic River, independent of the Syntana-Utah project.

The most significant impacts on recreation resources would result from the population growth associated with project implementation. The project would cause a population increase of 3,249 people in 1985 (peak construction year), and 8,131 people in 1995 (peak operation year) (Section S-4.A.1, Socio-economics).

All types of recreation use would be expected to increase. Of the most concern for protection of other resources would be the predicted increase in off-road vehicle (ORV) use and the proliferation of new trails (see Section S-4.A.4, Vegetation, Soils, and Reclamation; Section S-4.A.6, Agriculture; Section R-4.A.10, Cultural Resources). Increase in ORV activity could also lead to increase in conflicts between different types of recreation users (for example, fishermen or hikers versus ORVers).

The activities most likely to be affected by the population growth are hunting and fishing. It is estimated that the number of hunting and fishing days would increase substantially, especially by 1995 when the project would be in full operation. The increase in the number of hunters and the lowering of the success ratio would lower the quality of the hunting experience. It also could increase the possibility of hunting accidents, since more people would be hunting, with increased contacts between hunters. The incidence of poaching, especially with a proposed on-site construction camp, would also be expected. This would lower the success ratio and quality of hunting experiences for those legally hunting in season.

Population increases, including the influx of up to 1,000 construction workers living in the proposed construction camp in 1985 (peak construction) could affect urban recreation facilities in Vernal, Rangely, and other surrounding communities. The proposed construction camp would have recreation facilities (Section S-1.D.1), but the amount and kind have not been identified (see Appendix R-I, Uncommitted Mitigation, for suggested mitigation). If the camp is not adequately planned, the urban recreation facilities could become overcrowded and result in social problems (Davenport 1979).

S-4.A.9 CULTURAL RESOURCES

The Syntana-Utah project would cause land modification that could affect cultural resources as described in Section R-4.A.10, Cultural Resources.

A portion of the leased lands for the Syntana-Utah project have been surveyed for cultural resources in compliance with 36 CFR 800, E.O. 11593 and other historic preservation legislation. The remaining rights-of-way would have to be surveyed and evaluated for significant cultural resources.

Site 42 UN 949 is considered significant and would be adversely affected by land modification from project development on the leased area.

S-4.A.10 VISUAL RESOURCES

The visual resource of the areas that would undergo significant adverse impacts as a result of the proposed action and alternatives (including the duration and total number of acres that would be affected) are summarized in Table S-4-5. Refer to Appendix R-H, Visual Resource Management Methodologies, for a description of analysis procedures. The placement of the project in these areas would exceed the allowable levels of contrast for each class established for specific portions of the project area. Areas where impacts would exceed the acceptable levels of contrast for a specified VRM class are placed in VRM Class V (indicating rehabilitation would be necessary). Refer to Section R-4.A.11, Visual Resources, for a description of the criteria used to determine significance of visual resource impacts that would occur if the project were constructed.

S-4.A.11 MINERAL AND ENERGY RESOURCES

The Syntana-Utah project data indicates that the project would extract nearly 90 percent of the energy value of the oil in the shale. Part of this abnormally high recovery rate may be due to the fact that the project would include a Tosco retort to clean up the fines that could not be used in the three Superior retorts proposed. The methodology used to determine these figures is discussed in Section R-4.A.13, Mineral and Energy Resources, and Appendix R-L.

TABLE S-4-5

SIGNIFICANT ADVERSE VISUAL RESOURCE IMPACTS

Component	VRM Class	Acres Significantly Affected	Location And Duration Of Impacts	Explanation
Proposed Action				
Plant and Facilities	IV	330	All above-ground facilities as viewed from the county road, or where facilities would cross above county road (long-term); within lease area.	Contrast in form, line, color of facility structure; contrast created from removal of vegetation; contrast in modification of landform.
Water Supply System	II	2	0.5 mile from White River Dam Reservoir (long-term); within right-of-way.	Contrast with removal of vegetation as seen from White River Dam Reservoir.
Spent Shale Disposal	IV	500	0.5 mile viewing distance from county road (long-term); within lease area.	Contrast in landform modification and vegetation change, as viewed from county road.
Product Pipeline	II	48	Viewed from White River for approximately 10 miles from Rangely westward (long-term); within right-of-way.	Contrast in vegetation removal as viewed from the White River.
Alternative				
Green River Water Supply System	II	2	Viewed from White River for approximately 0.5 mile (long-term); within right-of-way.	Contrast in vegetation removal as seen from White River.
Disposal Area Bypass	IV	74	All above-ground facilities and vegetative clearings as viewed from county road for approximately 2 miles (long-term); 1 mile within lease area and 1 mile within right-of-way.	Contrast in form, line, color of transmission structures; contrast in vegetation clearings as viewed from county road.
Natural Gas Pipeline	IV	14	Viewed from county road for approximately 3 miles along northern portion of route (long-term); within right-of-way.	Contrast in vegetation removal as viewed from county road and Colorado Highway 64.

	Trillion Btu's/Year
Net Output	(108.600)
Energy in Shale	(121.400)
Other Fuels Used	(19.670)
Indirect Energy	(34.660)
Infrastructure	(17.480)
Total Input	193.210
Percent Efficiency	56.2%

This figure is a little higher than could be expected from a coal-fired electric power plant or producing oil by pumping a well.

S-4.A.12 EXISTING LAND USE PLANS

The proposed Syntana-Utah project would conflict with BLM's Bonanza Management Framework Plan, which states that all rights-of-way on federal land are to be located within designated corridors (see Map R-A-3 located in Appendix R-A). As proposed, 9.5 miles of the product pipeline, 9.5 miles of the natural gas pipelines and 1 mile of the water pipelines would be located outside of the right-of-way corridors designated in the plan. Also, the proposed water intake structure at the White River would conflict with the plan, which establishes a no-occupancy zone (0.5 mile wide or line-of-sight) along the White River. For land ownership designations see Table S-1-1 (Section S-1.C.3).

Although not presently in conflict, parts of the proposed action may become in conflict with the Uintah County plan. The proposed project area is currently zoned for mining and grazing in the Uintah County Zoning Ordinance, but the county is presently developing a new land use master plan. However, the new plan is likely to consider the proposed energy developments and not present constraints that would ban orderly development of the Syntana-Utah project.

S-4.B **GREEN RIVER ALTERNATIVE WATER SUPPLY SYSTEM**

Under this alternative, Green River water would be purchased out of storage from Flaming Gorge Reservoir (from the Bureau of Reclamation) and transported from the Green River via a 28.4-mile long pipeline to the Syntana-Utah plant site. About two-thirds of the pipeline would parallel the water pipeline for the Bonanaza Power Plant. Impacts for that pipeline (as discussed in the Moon Lake Power Plant EIS (BLM 1981c) would be applicable to the Syntana-Utah pipeline).

About 274 acres would be disturbed by the pipeline and water intake structures. Because the area that would be affected by this alternative does not vary significantly from the area that would be affected by the proposed action, impacts of this alternative would be similar to those of the proposed action for socioeconomics, air quality, vegetation, soils, wildlife, cropland, transportation networks, wilderness, and visual resources.

GREEN RIVER ALTERNATIVE-DISPOSAL AREA BYPASS ALTERNATIVE

A total of 9 AUMs would be lost for 1 to 5 years due to implementation of this alternative which would not be considered a significant impact.

The alternative water pipeline would cross high priority value pronghorn antelope range. The hunting quality along the alternative water pipeline right-of-way would be temporarily diminished during and following completion of construction. Pipeline construction activity could likely disturb and cause some degree of migration of antelope from the generally affected area. This would likely result in a temporary decrease in hunting success ratios and lower the quality of the hunting experience (Section S-4.A.8, Recreation). However, reclamation is predicted to successfully restore the area within a period of 5 years and eventually have no impact upon hunting quality for antelope along the alternative water pipeline right-of-way. Effects to cultural resources cannot be quantified, since surveys have not been conducted for that portion of the pipeline route from the Bonanza Power Plant to the Syntana-Utah plant site.

S-4.C DISPOSAL AREA BYPASS ALTERNATIVE

Under this alternative, the existing Chevron pipeline and other paralleling pipelines would be relocated to avoid the proposed spent shale disposal area. Four lines would have to be moved, increasing each of their lengths by 0.8 miles.

About 128 acres of vegetation would be disturbed through relocation of these lines. The new routes would be within 1 mile of the existing Chevron pipeline right-of-way. Since the land affected by this alternative is not significantly different from the land that would be affected by the proposed action routes, impacts would be similar to those of the proposed action for socioeconomics, air quality, vegetation, soils, wildlife, cropland, transportation networks, recreation, wilderness, and cultural resources. However, visual resources would be significantly affected in that 74 acres in VRM Class IV would be changed where the new above ground facilities would be placed along the county road.

However, a total of 8 AUMs would be lost for 1 to 5 years with the net result that 2 animals would be removed from the range at the discretation of the manager. This loss would not be considered significant.

S-4.D MORMON GAP ALTERNATIVE NATURAL GAS PIPELINE

Under this alternative, the natural gas pipelines would follow a slightly different route than the proposed action for 6 miles. Most of these 6 miles would follow an existing road and the existing MAPCO liquid hydrocarbons pipeline (BLM 1980e). The length of the pipelines would be the same as the proposed action.

About 106 acres would be disturbed by construction of the natural gas pipeline. Because the land that would be affected by this alternative does not vary significantly from the land that would be affected by the proposed action resource impacts of this alternative would be about the same as those for the

proposed action. This alternative, however, would concentrate the impacts in a corridor where previous land disturbance has already occurred, rather than introduce the impacts into a new area. The visual resource impacts would be significantly less than for the proposed action in that only 14 acres would be significantly affected in VRM Class IV area.

This alternative would conflict with BLM's Bonanza Management Framework Plan (Section R-3.A.14, Existing Land Use Plans), because 6 miles of the natural gas pipeline would be located outside the proposed right-of-way corridor.

S-4.E NO-ACTION ALTERNATIVE

Under this alternative, the requests for the federal rights-of-way would be denied. Refer to the No-Action Alternative section of the Site-specific Analyses Introduction of this EIS for an explanation of the purpose of this alternative.

Denial of the proposed federal rights-of-way would prohibit development of the Syntana-Utah project. Consequently, the impacts associated with the proposed action would not occur; however, the purpose of the proposed project (Section S-1.A.1) would not be achieved. Similarly, the national goal to reduce dependence on foreign oil sources (discussed in the Site-Specific Analyses Introduction) would be harder to achieve without the 57,000 bpsd of shale oil projected for production by this project. In addition, a financial impact of unknown amount would occur to Syntana-Utah.

proposed action. This alternative, however, would concentrate the impacts in a corridor where previous land disturbance has already occurred, rather than introduce the impacts into a new area. The visual resource impacts would be significantly less than for the proposed action in that only 10 acres would be significantly affected in VRM Class IV area.

This alternative would conflict with BLM's Diamond Management Framework Plan (Section R-3/A.14, Existing Land Use Plans), because 6 miles of the natural gas pipeline would be located outside the proposed right-of-way corridors.

5-4.E.9.3 NO-ACTION ALTERNATIVE

Under this alternative, the requests for the federal rights-of-way would be denied. Refer to the No-Action Alternative section of the Site-Specific Analyses Introduction of this EIS for an explanation of the purpose of this alternative.

Denial of the proposed federal rights-of-way would prohibit development of the Syntana-Utah project. Consequently, the impacts associated with the proposed action would not occur; however, the purpose of the proposed project (Section 5-4.A.1) would not be achieved. Similarly, the national goals to reduce dependence on foreign oil sources (discussed in the Site-Specific Analyses Introduction) would be harder to achieve without the 57,000 tons of shale oil projected for production by this project. In addition, a financial impact of unknown amount would occur to Syntana-Utah.

S-5.A **CUMULATIVE IMPACTS**

Cumulative impacts result when a new project is developed in an area in which other projects exist or are proposed. Although the impacts from the individual projects might be minor, the impacts from all projects in an area could be significant. The interrelated projects considered in the cumulative impact analysis for the Syntana-Utah Oil Shale Project are listed in Tables R-1-2 and R-1-3. The projects proposed by the other applicants were not considered here, because the cumulative impacts of all the applicants' projects were discussed in Chapter R-4, Regional Environmental Consequences.

The assessment of cumulative impacts for the Syntana-Utah Oil Shale Project indicated that the only major cumulative impacts would occur to socioeconomics, air quality, wildlife, and agriculture.

S-5.A.1 SOCIOECONOMICS

Population and Employment

Adding the effects of the interrelated projects and the effects of the Syntana-Utah project, population in the Uintah Basin would be expected to increase by 5,389 people in 1985 and 24,532 people in 1995.

Uintah County would have the majority of population-related impacts. Duchesne County would also have significant population increases over its projected baseline. The Colorado area would have much larger population impacts with the inclusion of interrelated projects especially in 1995. However, the impacts would still be less than the significance criteria. The increase of population over baseline in 1995 would be 9.4 percent (742 persons). Rangely and Dinosaur would, however, exceed the significance criteria.

In 1985, Uintah County would have an increase of 16.7 percent (4,285 persons) while in 1995, this increase would reach 61.2 percent (18,266 persons) above projected baseline. Duchesne County's increase would only be 4.4 percent (785 persons) in 1985, but would rise to 19.7 percent (3,679 persons) in 1995.

Vernal would incur the largest increase for communities with the 14.8 percent (1,370 persons) population increase in 1985 and a 68.9 percent (7,834 persons) increase in 1995. Roosevelt's increase would be 9.1 percent (492 persons) and 40.9 percent (2,428 persons), respectively. Rangely would have very small population increases in 1985 (5.4 percent or 179 persons). In 1995 however, the increase over baseline would be 36.6 percent (1,393 persons). Dinosaur's increase would be 11.0 percent (140 persons) in 1985. Dinosaur's increase would rise dramatically relative to the small baseline and would be 100.5 percent (1,194 persons) above baseline levels.

CUMULATIVE IMPACTS-SOCIOECONOMICS

Employment increase would center in Uintah County. In 1985, the increase over baseline would be 12.7 percent (1,347 persons). In 1995, they would exceed baseline by 77.5 percent (9,215 persons). Duchesne County's impacts would be much smaller with increases of 4.4 percent (137 persons), and 19.7 percent (802 persons), respectively. The Colorado area would capture very few of the increases in employment, 6.0 percent (684 persons) over baseline in 1995.

Housing

Uintah County would have the highest housing demand increases. In 1985 the housing demand increases over demand would be 13.3 percent (1,026 households) and 49.1 percent (4,211 households) in 1995. Duchesne County would have a small increase in additional demand, but in 1995, the increase would be substantial at 19.6 percent (1,051 households).

Vernal would incur most of the increased household demands with increases of 14.7 percent (453 households) in 1985 and 61.6 percent (2,230 households) in 1995. Roosevelt's increase would again, be small in 1985, but in 1995 the increased demand would be 42.7 percent (725 households) over baseline. Rangely's increases would also peak in 1995 at 32.1 percent (427 households) above baseline. Dinosaur's increases would be small in 1985 (8.5 percent) but extremely large compared to the small baseline in 1995. Increased demand would be 86.1 percent (366 households).

Such a large increase in households would require substantial expansion of the existing housing. This would likely create serious housing shortages. Temporary housing developments such as mobile home parks would likely develop. Also, with such shortages, the unauthorized settlement of squatters on public lands would become a more serious problem.

Personal Income

Personal income increase from the Syntana-Utah project and the interrelated projects would be $115.9 million in 1985 and $337.8 million in 1995.

Government Services and Facilities

Uintah County would have the largest increase in education-related demands. In 1985, the demand for classrooms and teachers would increase by 27 or 9.9 percent over baseline. In 1995, impacts would be much larger, with 190 or 51.8 percent increase. Duchesne's peak impacts would occur in 1995 with 28 more teachers and classrooms being in demand. The communities in Colorado would have adequate classroom capacity to handle additional demand. Uintah and Duchesne counties would have to expand their facilities in order to meed the demand.

Uintah County's impacts to health services would peak in 1995 with 37 additional hospital beds or 61.7 percent increase in projected demand. The demand for physicians and nurses would also increase substantially in 1995 with the need for 12 or 44.4 percent additional physicians over baseline and 37 or 45.7 percent additional nursing staff.

The area of influence would need an additional 4 social workers and 1 psychiatrist in 1995.

Uintah County would experience the major impacts to law enforcement. In 1995, 21 additional policemen would be in demand which would be 60 percent higher than projected demand. Also, 5 additional police cars would be required over the future baseline demand.

Vernal would have the majority of sewer demand increases, with a 68.9 percent increase over baseline in 1995. This demand could be handled if the planned expansion of the sewer system is constructed on schedule. Roosevelt's existing system could handle any increased demands.

Vernal would be most affected by project-related demands for water services. In 1995, water connections would have to increase by 68.5 percent over baseline to meet the additional demands. The planned expansion of the existing water system could meet these demands. Any increases to Roosevelt's could be met by the existing water system. Dinosaur would have to substantially increase the number of well permits or build a water treatment system in order to meet the increased demands.

Uintah and Ouray Indian Reservation

Adding interrelated projects to potential impacts from the Syntana-Utah project would substantially increase the potential impacts to the reservation. This is because the impacts from the Syntana-Utah project alone are expected to be not very significant given the substantial distance from the reservation. Impacts from the Syntana-Utah project and the interrelated projects would be the same as those described in Section R-4.A.1., Socioeconomics. However, impacts would be much less than the cumulative effects from all projects discussed in the regional analysis.

Quality of Life

The level of population growth associated with this level of development would have significant local social effects in Duchesne County and the Rangely, Colorado, area. However, the changes would be most pronounced in Uintah County. In each case, the effects, at a somewhat lower order of magnitude, would be similar to those described under the regional high-level scenario (Section R-4.A.1).

S-5.A.2 AIR QUALITY

Cumulative increment consumption is compared with the PSD increments in Table S-5-1, which shows that no PSD incremental limitations would be exceeded. Table S-5-2 compares maximum pollutant concentrations with the National Ambient Air Quality Standards (NAAQS), and shows that no NAAQS violations would occur, with the possible exception of the 24-hour total suspended particulate standard, due mainly to high baseline levels as discussed in Section S-4.A.2, Air Quality.

TABLE S-5-1

COMPARISON OF PSD INCREMENTS WITH CUMULATIVE INCREMENT CONSUMPTION

	SO_2 Concentration (ug/m^3)[a]			TSP Concentration (ug/m^3)[b]	
PSD Increments/Increment Consumption	3-Hour Average	24-Hour Average	Annual Average	24-Hour Average	Annual Average
Class II Areas					
PSD Class II increment	512	91	20	37	19
Cumulative increment consumption	47	9	1	18	1
Cumulative increment consumption at Uintah and Ouray Indian Reservation	22	4	0	less than 16	0
Class I Areas					
PSD Class I increment	25	5	2	10	5
Cumulative increment consumption at Flat Tops Wilderness Aea (federal Class I)	1	0	0	0	0
Cumulative increment consumption at Maroon Bells-Snowmass Wilderness Area (federal Class I)	0	0	0	0	0
Cumulative increment consumption at Dinosaur National Monument (Colorado Category I and potential federal Class I)	7	1	0	1	0
Cumulative increment consumption at Colorado National Monument (Colorado Category I and potential federal Class I)	0	0	0	0	0

a Calculated using the SAI Gaussian Puff Model with a 5-kilometer grid spacing.
b Class II increment calculated using EPA Complex I Model with a 1-kilometer grid spacing; Class I consumption calculated using the SAI Gaussian Puff Model with a 5-kilometer grid spacing.

TABLE S-5-2

COMPARISON OF CUMULATIVE MAXIMUM GROUND-LEVEL POLLUTANT CONCENTRATIONS WITH THE NATIONAL AMBIENT AIR QUALITY STANDARDS (NAAQS)

Pollutant/Averaging Time	Maximum Cumulative Ground-Level/Concentrations (ug/m^3)[a]	NAAQS ug/m^3
Sulfur Dioxide (SO_2)	49	1,300
3-Hour	10	365
24-Hour	1	80
uspended Particulate (TSP)		
24-Hour	171	150
Annual	40	60
Nitrogen Dioxide (NO_2)		
Annual	7	100
Carbon Monoxide (CO)		
1-Hour	220	40,000
8-hour	220	10,000
Ozone (O^3)		
1-Hour	72	240
Hydrocarbons (HC)		
3-Hour	20	160

NOTE: It is conservatively assumed that baseline maximum, Syntana maximum, and interrelated projects maximum all coincide.

[a]Includes baseline, applicants facility, and interrelated projects.

S-5.A.3 WILDLIFE

It is anticipated that there would be no cumulative impacts to wildlife from the loss of habitats due to the applicant's proposal and the interrelated projects, because the total amount of habitat removal would approximate a less than 1 percent of the total habitat available in the Uintah Basin. However, the influx of new people into Uintah County due to the Syntana-Utah project and interrelated projects would cause direct and indirect impacts to wildlife. (Uintah County is the only area where cumulative impacts to wildlife are expected to be significant.) Indirect impacts to wildlife caused by an estimated influx of 4,285 new people in 1985 and 18,226 new people by 1995 include, but are not limited to harassment, poaching, and wanton killing, resulting in possible wildlife population reductions. It is estimated that losses from poaching and wanton killings would increase about 16.7 percent by 1985 and by 61.2 percent by 1995 because of the increase in human population. Other indirect impacts include an estimated 16.7 percent increase in demand for the opportunity to hunt and fish by 1985. There would also be about a 16.7 percent increase in competition for limited licenses or permits by 1985, which would reduce the chances of local sportsmen obtaining these permits at the same rate they now enjoy.

S-5.A.4 AGRICULTURE

Cropland

Implementation of the Syntana-Utah project along with the interrelated projects would cause a predicted population increase of 24,532 by the peak operation period (1995). The projected population growth associated with the peak operation period would remove an estimated 5,397 acres of cropland, including prime agricultural land, to homesites and other related urban development in the Ashley Valley-Jensen and Rangely areas. This is approximately 6.1 percent of the cropland in the region. This land use conversion would contribute to the loss of cropland in the region, as discussed in Section R-4.A.6, Agriculture.

S-5.A.5 RECREATION

Based on the expected cumulative construction-related population growth in the area of influence (Uintah and Duchesne counties, Utah; Grand, Mesa, Moffat and Rio Blanco counties, Colorado) of 8,263 people in 1985 (peak construction year), and a cumulative operation-related population growth of 30,860 people in 1995 (peak operation year), cumulative and significant impacts would likely result to hunting, water-oriented recreation, and municipal leisure-time activities.

Big and small game hunting opportunities and experiences within the Syntana-Utah project area and adjacent areas such as the Uintah and Ouray Indian Reservation and the Ashley National Forest would be affected, especially by 1995 with the projected population growth and land disturbance. Hunting success and the quality of hunting as a recreational experience would generally diminish because of increased hunting competition, increased

incidences of hunter contacts, and competition for hunting permits. Poaching and wanton killing of wildlife along the Green and White river basins would also be expected to increase (Bradley 1976).

The influence of the proposed White River Dam Project in the general vicinity of the Syntana-Utah project area would significantly enhance other outdoor water-based recreation opportunities.

Deficiencies in the quality and supply of municipal leisure-time indoor facilities in Vernal and Roosevelt, Utah, and Rangely, Colorado would be anticipated. By 1995 (peak operation year), there would be a 68.9 percent increase over baseline projections in people expected to be permanently residing in Vernal, a 40.9 percent increase in Roosevelt, and a 36.6 percent increase in Rangely. Vernal currently needs an additional year-round indoor swimming facility (DOE 1981). Roosevelt would need additional parks. Rangely would need additional park acreage and day-use areas (Bartlett 1982). All three communities would have to upgrade and expand existing recreation facilities as demands for quality facilities and activities became more and more acute.

incidences of hunter contacts, and competition for hunting permits. Poaching and wanton killing of wildlife along the Green and White river basins would also be expected to increase (Bradley 1978).

The influence of the proposed White River Dam Project in the general vicinity of the Syntana-Utah project area would significantly enhance other outdoor water-based recreation opportunities.

Deficiencies in the quality and supply of municipal leisure-time indoor facilities in Vernal and Roosevelt, Utah, and Rangely, Colorado would be anticipated. By 1995 (peak operation year), there would be a 65.9 percent increase over baseline projections in people expected to be permanently residing in Vernal, a 50.7 percent increase in Roosevelt, and a 38.6 percent increase in Rangely. Vernal currently needs an additional year-round indoor swimming facility (UDE 1981). Roosevelt would need additional parks. Rangely would need additional park acreage and day-use areas (Bartlett 1982). All three communities would have to upgrade and expand existing recreation facilities as demands for quality facilities and activities became more and more acute.

T-1.A INTRODUCTION

Tosco Development Corporation (Tosco) proposes to develop the Sand Wash Project, a shale oil facility. The plant site and mines would be located on 16,452 acres leased from the State of Utah in Uintah County, Utah. Construction is scheduled to commence in early 1983 and would continue through 1989. Limited commercial operation of the project would begin in 1988 with full production of approximately 44,953 barrels per stream day (bpsd) anticipated by 1989. Development of the project would require the issuance of rights-of-way by the ureau of Land Management (BLM) Vernal District Office.

This chapter focuses on impact causing aspects of the proposed project and alternatives to that project. More detailed information about all aspects of the Tosco project is included in the Project Description Technical Report (Tosco 1982). Copies of this report can be obtained from Mr. John Hardaway, Tosco Development Corporation, 11100 East Bethany Drive, P.O. Box 441464, Aurora, Colorado 80014-1439. Copies are also available for review in Tosco's Denver office, in public libraries located in and near the Uintah Basin, and in the Salt Lake City and Denver main public libraries.

T-1.A.1 PURPOSE AND NEED OF PROPOSED PROJECT

Purpose

The purpose of the project is to produce 44,953 bpsd of hydrotreated shale oil, 3,750 bpsd of liquefied petroleum gas (LPG), 162 long tons per stream day (tpsd) of sulfur, 145 short tpsd of ammonia, and 805 short tpsd of coke.

Need

The need for this project and other proposed synthetic fuel projects in the Uintah Basin is similar. This need is discussed in the Site-specific Analyses Introduction of this environmental impact statement (EIS).

T-1.A.2 LOCATION

The Tosco Sand Wash Project would be located approximately 35 miles south of Vernal, Utah, near the towns of Ouray (11 miles northwest) and Bonanza (19 miles east). The project site would be generally south of the White River, and south of a portion of the Uintah and Ouray Indian Reservation (Map R-1-1 in Section R-1.A). Road access would be from U.S. Highway 40 and Utah State Highways 45 and 88.

T-1.A.3 AUTHORIZING ACTIONS

To implement the Tosco project, certain federal, state, and local authorizing actions would have to be taken. Most of the actions that would be required to authorize the various synfuel projects in Uintah County are similar; these are identified in the Site-specific Analyses Introduction of this EIS. The specific BLM actions that would be required for authorization of the Tosco project are granting the following rights-of-way across federal land:

35.0	miles for access roads
10.0	miles for interblock rosds and conveyors
1.0	miles for underground tunnels
0.6	miles for water pipeline
37.0	miles for transmission line

Tosco has applied for all these rights-of-way.

T-1.A.4 INTERRELATIONSHIPS WITH OTHER PLANNED PROJECTS AND SPECIAL MANAGEMENT AREAS

Projects

The interrelated projects that occur in the area of influence of the Uintah Basin synfuels development are shown in Tables R-1-2 and R-1-3 in Section R-1.A.

Special Management Areas

Approximately 6.5 miles of access road would cross lands of the Uintah and Ouray Indian Reservation.

T-1.B **HISTORY AND BACKGROUND**

T-1.B.1 LEASES

In 1973, Tosco purchased from a third party 38 oil shale leases issued by the State of Utah covering approximately 20,000 acres. In 1978, an additional 640 acre lease was acquired from the state. Thirty-three of these leases, totaling about 17,000 acres, have been combined by the state into a Unit Agreement and Cooperative Plan of Development ("Unit Plan") for the Sand Wash Project area. The Unit Plan provides for the orderly development of unitized leases and extends the lease terms indefinitely, provided that Tosco pays prescribed minimum royalties to the state beginning in 1984. No federal leases would be involved in the Sand Wash project.

T-1.B.2 PERMITS

A federal Prevention of Significant Deterioration Permit was issued to Tosco Development Corporation for the Sand Wash Project on December 10, 1981.

Action on the following water right applications is pending by the Utah State Engineer:

Application 37943 filed October 1966 for 50 cubic feet per second of White River water.
Application 43161 filed January 1974 (amended September 1974) for 25 cfs of White River water.
Application 44191 filed September 1971 for 25 cfs of Green River water.

As discussed later in this chapter, Tosco's proposed water source is the proposed White River Dam.

T-1.C **OVERVIEW OF PROPOSED ACTION AND ALTERNATIVES**

T-1.C.1 GENERAL DESCRIPTION

The proposed Sand Wash Project is patterned after the Colony Project in western Colorado, and many of the same types of components, construction procedures, and federal and state standards would be used. An EIS on the Colony Project was prepared by the BLM in 1976 (BLM 1976). A project life of 35 years for the Sand Wash Project is planned.

The proposed project would involve the mining of 66,000 tons of oil shale per stream day, processing it to recover crude shale oil, upgrading the crude to produce a premium quality shale oil product, transporting the oil by pipeline to Rangely, Colorado, and disposing the spent shale after processing.

The proposed project would consist of the following major components:

1. three underground room-and-pillar mines and associated facilities totaling 16,452 surface acres and ranging in depth from 1750 to 2340 feet)

2. 1,086-acre processing plant with TOSCO II retorts and shale oil upgrading units

3. 42-mile product pipeline to Rangely, Colorado

4. 2,000-acre spent shale disposal area

5. wastewater treatment system

6. solid and hazardous waste treatment system

7. ancillary facilities including
   3 access roads (49 miles total)
   water pipeline (5.9 miles)
   power supply system (43 miles)
   interblock roads and conveyors (22.7 miles)

The overall project schedule as submitted by Tosco is shown in Figure T-1-1. This schedule is subject to change based upon completion of the EIS and decisions on the requested rights-of-way grants. The estimated time required from start of construction to full-scale production is six years.

In addition to the proposed project, the following alternatives to the Sand Wash project were analyzed in detail: (1) component alternatives--Shale Oil Upgrading Alternative, White River Section 17 Alternative Water Supply System, White River Dam Alternative Water Supply System, Interblock Corridor White River Dam Alternative, North Route Alternative Power Transmission Line, Salt Lake City Alternative Project Pipeline, Alternative Access Roads; and (2) project alternatives--Blocking-Up Alternative and No-action.

T-1.C.2 LOCATION OF COMPONENTS

The proposed plant site, including mines, would be generally located in Township 9 and 10 South, Range 21 and 22 East of Uintah County, Utah. Map T-1-1 shows the proposed location of the various plant and mine components and the rights-of-way on the lease area. Map R-A-1 (located in Appendix R-A) shows the location of all rights-of-way and their relationships to the other proposed synfuel projects in the Uintah Basin.

T-1.C.3 LAND STATUS AND OWNERSHIP

The proposed project area, including components on the lease area and the off-site rights-of-way, would require federal, state, and private lands. Table T-1-1 shows the miles and acres of each type of land required for components of the proposed project and alternatives. Map R-A-3 (located in Appendix R-A) shows the land ownership graphically. (Additional information on land status also is given in Section T-1.E.9, Blocking-Up Alternative.)

T.1.D **PROPOSED ACTION**

T-1.D.1 CONSTRUCTION, OPERATION, MAINTENANCE, AND ABANDONMENT

Construction

Construction of the Tosco project would begin in 1983 and continue on a phased basis through 1989. As shown in Figure T-1-1, many construction activities would proceed simultaneously. Initial activities would include site preparation and construction of access roads, laydown areas, drainage systems, sediment control basins, and all temporary building and support facilities necessary for construction. Development of the mine and process plant would begin later. Approximately 2,787 acres would be disturbed by construction activities.

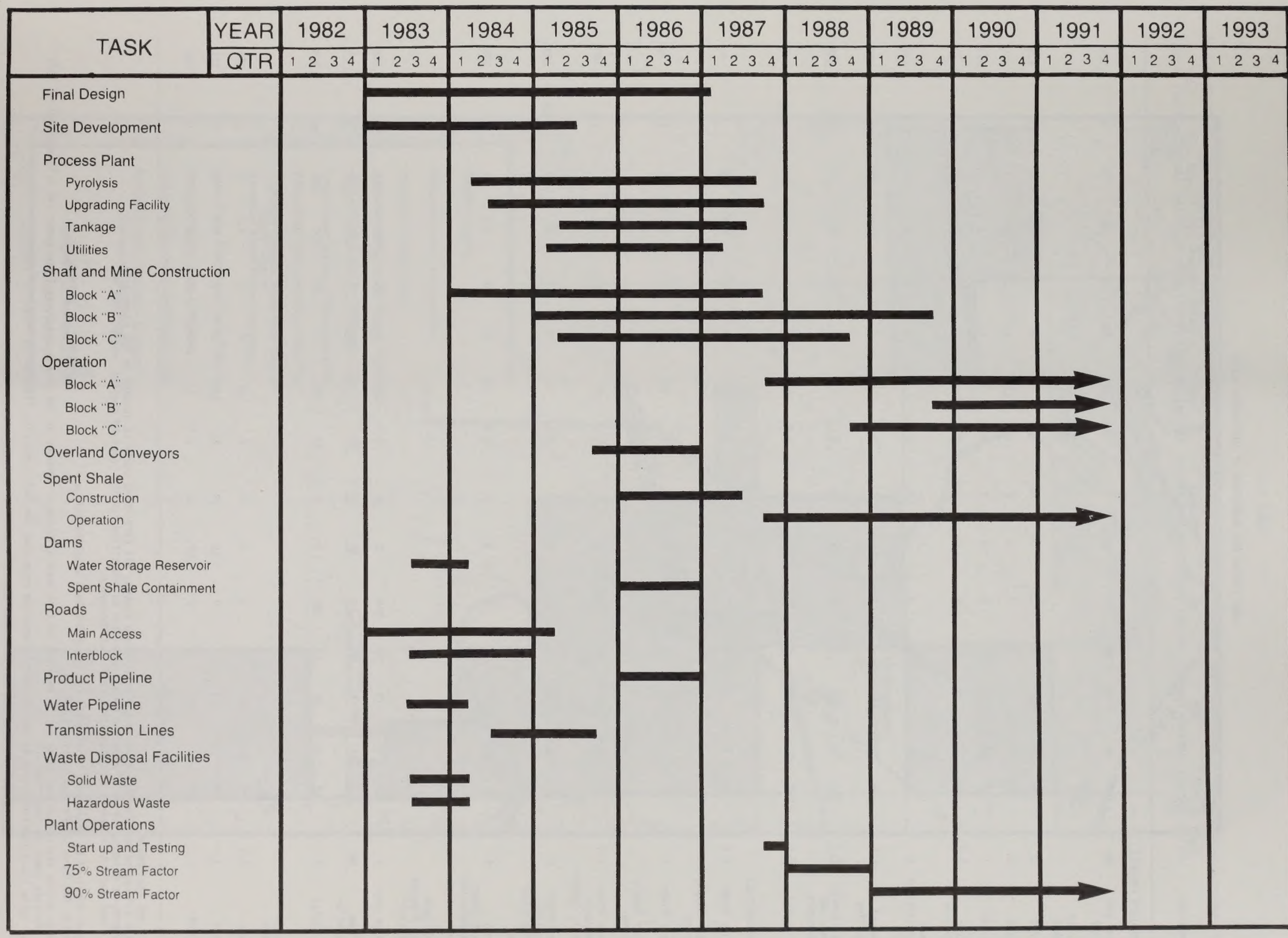


FIGURE T-1-1. TOSCO SANDWASH PROJECT SCHEDULE

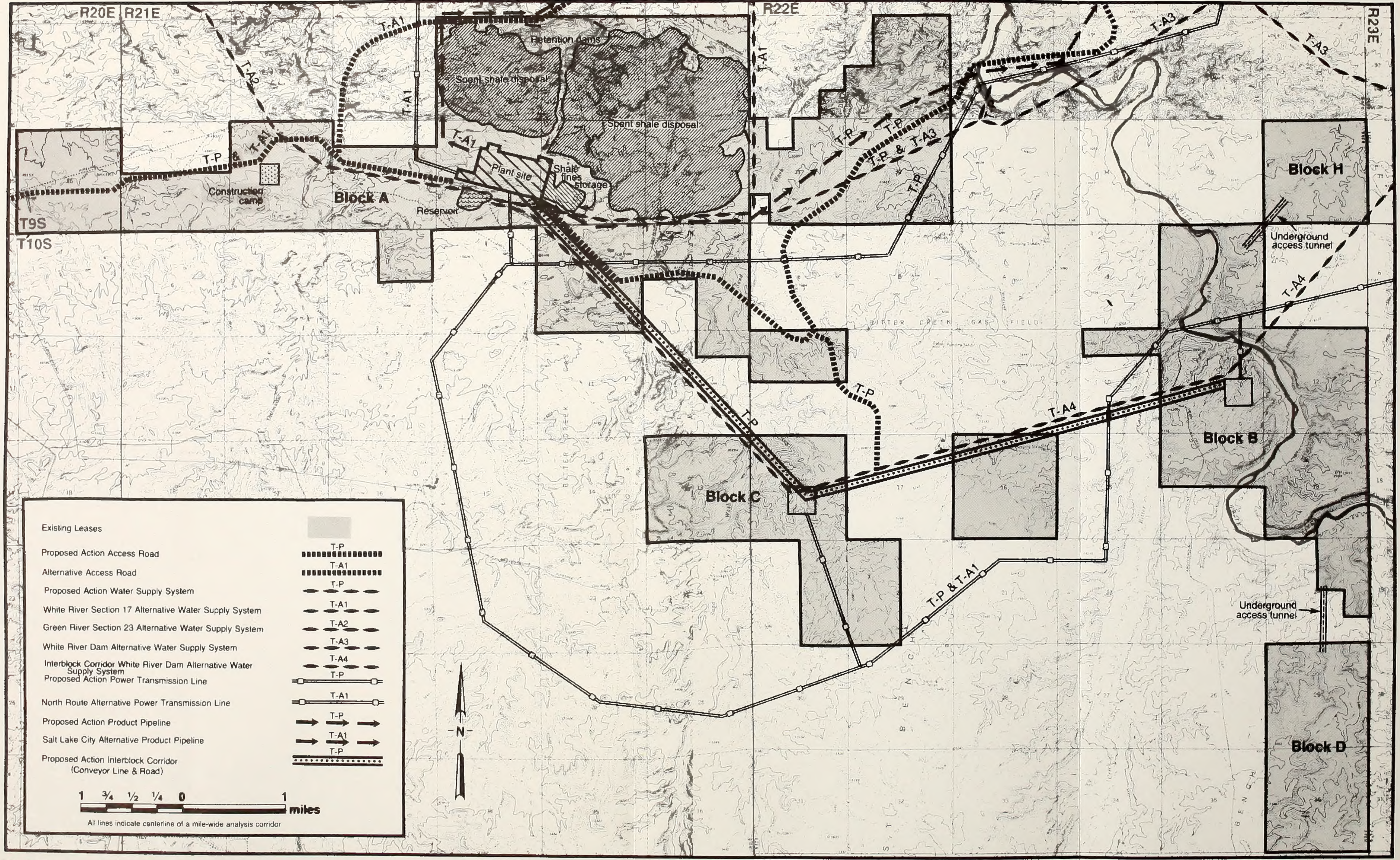
TABLE T-1-1

LAND STATUS AND OWNERSHIP OF DISTURBED ACRES

Component	State of Utah (Miles)	State of Utah (Acres)	BLM (Miles)	BLM (Acres)	FS (Miles)	FS (Acres)	FWS[a] (Miles)	FWS[a] (Acres)	Indian[b] (Miles)	Indian[b] (Acres)	Indian Alloted[c] (Miles)	Indian Alloted[c] (Acres)	Private (Miles)	Private (Acres)	Total (Miles)	Total (Acres)
PROPOSED PROJECT																
Mine and Plant	NA	3,086	NA	0	NA	0	NA	0	NA	0	NA	0	NA	0	NA	3,086
Access Roads																
East	2	79	21	835	0	0	0	0	0	0	0	0	0.5	0	23	419
West	4	73	1	18	0	0	0	0	6.5	118	0	0	0	9	12	218
North	1	18	13	233	0	0	0	0	0	0	0	0	0	0	14	251
Water Pipeline	5.3	36	0.6	5	0	0	0	0	0	0	0	0	0	0	5.9	41
Power Transmission Line	6	22	37	135	0	0	0	0	0	0	0	0	0	0	43	157
Product Pipeline	12.5	95	19	145	0	0	0	0	0	0	0	0	10.5	80	42	320
Interblock Roads and Conveyors	12.7	167	10	131	0	0	0	0	0	0	0	0	0	0	227	298
Total	43.5	3,576	101.6	1502	0	0	0	0	6.5	118	0	0	11	89	162.6	4,790
ALTERNATIVES																
White River S. 17 Water Supply System	2.4	18	1	8	0	0	0	0	2	16	0	0	0.6	5	6	47
Green River S. 23 Water Supply System	2	14	3	22	0	0	0	0	8	58	0	0	0	0	13	94
White River Dam Water Supply System	6.4	47	12.6	93	0	0	0	0	0	0	0	0	0	0	19	140
Interblock Corridor White River Dam	6	44	12.8	95	0	0	0	0	0	0	0	0	0	0	18.8	139
North Route Power Transmission Line	4	15	35	128	0	0	0	0	6.5	24	0	0	0.5	2	46	169
Salt Lake City Product Pipeline[d]																
Pipeline	2	16	2	16	18	140	2	16	29	226	2	16	105	818	160	1,248
Pump Station	NA	0	NA	0	NA	0	NA	0	NA	0	NA	0	NA	6	NA	6
Total	2	16	2	16	18	140	2	16	29	226	2	16	105	824	160	1,254
Access Roads																
East	2.5	46	13	240	0	0	0	0	5	92	0	0	0.5	9	21	387
West	3.5	80	1	23	0	0	0	0	6	137	0	0	0.5	11	11	251
North	1.5	28	10	187	0	0	0	0	2.5	47	0	0	0	0	14	262

NA = not applicable
Shale Oil Upgrading Alternative would not affect land status; all facilities would be located on the plant site.
Blocking-Up Alternative would have the same land status as identified for the proposed project, except that no land would be required for interblock roads and conveyors.

[a]Lands acquired by Department of Interior for Ouray National Wildlife Refuge.
[b]Uintah and Ouray Indian Reservation lands.
[c]Lands within the Uintah and Ouray Indian Reservation that were allotted to members of the Uintah and Ouray Tribe under the Allotment Act of 1905 (Private lands of inheritance.)
[d]See Table T-1-2 (Section T-1.E.6) for further information regarding the Salt Lake City Alternative Product Pipeline.



MAP T-1-1 TOSCO LEASE AREA FACILITIES

The construction work force would peak in 1986 at 3,460 workers plus or minus 25 percent, where the variation would be due to shift scheduling and other factors. Single or unaccompanied workers chosing temporary camp housing would be housed on site at a location west of the plant construction site on Block A (Map T-1-1); married personnel would be housed off site in a combination of facilities planned in concert with state, local and tribal representatives. The ultimate configuration of the construction camp and the scope of facilities would depend upon Tosco's judgment as to the best methods for maximizing worker productivity, minimizing commuter traffic, and maintaining high levels of employee satisfaction. The facilities being considered include cafeteria, indoor and outdoor recreation facilities, laundry and dry cleaning facilities, and medical facilities.

During construction, large amounts of heavy equipment and materials would be moved to the plant site. The proposed route for transporting these items is from the railhead at Mack, Colorado, via Route 6, Route 139, and Douglas Pass. Use of this route would require road improvement and upgrading to handle the required tonnage. The types of vehicles involved and the frequency of their movements are unknown.

The approximately 323 ac-ft/yr of water required during the construction process would be trucked to the site from the White River until the permanent water supply system is completed. During the early stages of construction, power would be supplied by on-site generators. Ultimately, construction power would be provided by the power transmission line from the Bonanza Power Plant. Total power needed for construction is estimated to be 35 megawatts.

No hazardous wastes would be generated during the construction phase. However, solid and liquid wastes would be generated from surface operations, rock debris would come from shaft construction, and sanitary wastes would be produced. About 17,828 tons per year of solid and sanitary wastes would be produced. Solid wastes would be disposed in an on-site disposal area designed for the project and approved by the State of Utah. Until the permanent liquid waste treatment system is completed, all construction liquid wastes would be handled by a wastewater system keyed to the particular phase of construction activity.

The general construction procedures for this project that would minimize environmental impacts are identified below. They would be used where required by the authorizing agency and where final on-site design indicates they would be needed to minimize significant adverse impacts. (Additional procedures that would apply to the construction of the Salt Lake City Alternative Product Pipeline are identified in the alternative product pipeline technical report (BLM and USFS 1982).)

- Upon completion of construction activities, all disturbed areas that are not required for operation of the permanent facility would be returned as nearly as possible to pre-disturbance conditions. (See Appendix R-J for a summary of Tosco's procedures.)

- Suitable plant growth materials (soils or weathered bedrock) where available, would be removed and protected for further use before excavation or filling. These materials, would be used to aid with revegetation.

- Roads would be kept to minimum widths and maximum grades commensurate with safe operations in order to minimize disturbances.

- Off-road travel would be restricted.

- Cut and fill slopes would be made as flat as possible to accommodate a talus-soil cover that would facilitate permanent erosion control by revegetation.

- Benching would be used to break up long slopes, thereby reducing flow velocities and diverting surface runoff to more stable surfaces.

- Water from undisturbed areas would be diverted to avoid disturbed areas. Stream crossings would be minimized.

- Temporary erosion protection would be achieved through use of crimped straw or hay mulch in other biodegradable binders, netting, and straw dikes.

- Main access roads would be paved, while other frequently used roads would be periodically sprayed with water or the surface treated with chemical dust suppressants.

- Roads used for longer periods would be drained with side channels, culverts, and energy dissipators such as riprap at discharge points where flow velocities are excessive.

- Runoff from disturbed areas would be diverted to containment ponds and contaminated water would be treated and recycled.

- Critical or fragile areas from the standpoint of surface water hydrology or wildlife would be avoided, wherever possible, to minimize potentially adverse effects.

- Material excavated from shafts would be disposed as fill within facilities areas to avoid excessive land disturbance.

- Gravel pads would be used around ventilation shafts to control fugitive dust from the surrounding terrain.

- Light-vehicle traffic would be restricted to designated roads.

- Larger pillars in the mine beneath the facilities area and in the vicinity of the White River would be retained if design analysis and geotechnical data from mining show that surface subsidence could adversely affect the facilities or river.

- Stream crossing points would be carefully selected to reduce disturbance of riverbeds and banks. Construction periods would be selected to avoid periods of large runoff whenever possible.

- Areas disturbed by waste disposal would be surrounded by berms. Runoff that could be contaminated would be retained and properly treated, recycled, or evaporated.

- Disposal sites operated by Tosco would have surface and ground water monitoring systems. The spent shale embankment would also have a mass stability monitoring system.

- Electrical transmission lines would be spaced and designed to help avoid danger to raptors.

- Areas of intensive activity would be fenced where feasible and necessary to exclude range anamils and terrestrial wildlife.

- Disturbed areas, including the spent shale embankment, would be graded and revegetated to blend with surrounding undisturbed terrain.

- Certain above-ground facilities would be painted to blend in with surrounding terrain, while meeting safety (visibility) standards.

- Potential visual intrusions such as transmission lines, would be sited in a manner to minimize the instrusion consistent with safety and economic considerations.

Operation and Maintenance

Limited commercial mining operations are scheduled to begin in late 1987 with full operation scheduled for 1989. The anticipated peak operation work force would be 2,185 personnel plus or minus 25 percent, where the variation would be due to shift scheduling and worker productivity.

The overall production system developed for the Tosco project would consist of mining, crushing, retorting, upgrading of shale oil, and disposal and revegetation of spent shale. The commercial mine would rely on underground room-and-pillar mining techniques at each lease block area.

The shale would be reduced from "run-of-mine" chunks weighing up to several thousand pounds to half-inch size and smaller pieces in a series of steps. The crushed shale would be processed in TOSCO II retorts to produce crude shale oil. This shale oil would be processed in an upgrading facility to produce approximately 45,000 barrels per day of hydrotreated, low-sulfur, low-nitrogen synthetic crude oil. The processed shale, after being cooled and moistened, would be transported by conveyor to a disposal area.

Raw water and electrical power would be the only imported utilities required for the Tosco project. Fuels produced in the plant would be burned for plant fuel requirements. At full production, the Tosco facility would consume about 9,000 acre-feet of water per year, all of which would be used in the plant and mine for cooling water, steam generation, operation of the wet scrubbers, dust suppression, fire protection, sanitary sewage and drinking water. The water supply would be drawn from the White River. The proposed White River Dam (BLM 1982b) would retain water and control flows for the Tosco project.

The total amount of purchased power required on a per-stream-day basis would be approximately 201,000 kw per day. The Bonanza Power Plant near Bonanza, Utah, would provide the electric power.

Air emissions from the proposed Tosco project would be generated from the construction, mining, shale ore crushing and conveying, processing and spent shale operations. A wide variety of air pollution control measures would be used to reduce air emissions, including paving of major roads, baghouses for control of particulates at above-ground crushing stations and conveyor transfer points, water sprays, particulate scrubbers, sulfur recovery, enclosure of sources of dust, use of low sulfur fuels for in-plant power sources, and controlled combustion practices. The major pollutant emissions would be nitrogen oxides (786 kilograms per hour (kg/hr), hydrocarbons (183 kg/hr), and total suspended particulates (120 kg/hr). These emissions are those authorized by the EPA Prevention of Significant Deterioration permit issued to Tosco in 1981. They represent emissions expected from application of Best Available Control Technology.

A spill prevention and countermeasure plan would be in force. Pipelines would be routinely patrolled, and the oil pipeline would be constantly monitored for leaks. Emergency oil spill containment equipment would be available for every river crossing.

Additional general operation procedures for this project that would minimize environmental impacts are as follows:

- Solid, disposable wastes, excluding spent shale, would be segregated and disposed of in the licensed waste disposal site.
- Hazardous wastes would be segregated and disposed of in the approved storage and disposal site.
- Areas disturbed by waste disposal would be surrounded by berms. Runoff that could be contaminated would be retained and properly treated, recycled, or evaporated, as would other waste and surplus water.
- Areas disturbed by waste disposal would be stabilized and revegetated when disposal operations in the immediate area are completed.
- Disposal sites operated by Tosco would have surface and ground water monitoring systems. The spent shale embankment would also have a mass stability monitoring system.
- Overland conveyor would be designed to allow free migration of terrestrial wildlife.

Abandonment

At the end of the projected 35-year project life, the mine shafts would be sealed and capped. All above-ground facilities such as processing facilities, buildings, tanks, transmission lines, and similar items would be removed. Pipelines buried 2-feet deep or more would be left in place in order to minimize surface disturbance. Areas which have been disturbed would be regraded, covered with topsoil, and revegetated as necessary pursuant to approved reclamation plans. Refer to Appendix R-J for specific details regarding reclamation procedures.

T-1.D.2 PROJECT COMPONENTS

The General Mining, Processing, and Upgrading Techniques section included in the Site-specific Analyses Introduction of this EIS describes, in a general way, the mining, processing, and upgrading facilities that would be used in the Tosco project. This section includes specific details about these facilities that are pertinent to the Tosco project as well as details about the product pipeline, spent shale disposal, wastewater treatment, solid and hazardous waste disposal, and ancillary facilities.

Mine System

Oil shale mining would be accomplished through separate underground room-and-pillar mines located on each of the three major lease blocks (A, B, and C). Blocks D and H would be combined with Block B for mining purposes. (See Map T-1-1 for block locations.)

Two underground tunnels would be constructed from Block B; one into Block H and the other into Block D (Map T-1-1). The tunnels would be used as main haulage-ways for the mining operation. They would be constructed in the oil shale zone and would involve mining federally administered oil shale. No surface disturbance would occur as a result of these tunnels.

Numerous gas wells penetrate the mine zone at Sand Wash. Mining techniques designed to protect both the gas wells and the mine would be used. These techniques consist of accurately locating the penetration of the mine zone by the well by down-hole surveys, establishing adequate pillar areas around the wells in the mining zone, and ensuring that the extraction ratio in areas adjacent to the pillars is appropriate to control movement.

Ground water flowing into the mine shafts would be controlled by grouting before the sinking operation. Since some water inflow is possible through fractures and the shaft lining, a well injection system may be constructed, if required to dispose of excess water. Reinjection would be back into the Birds Nest aquifer.

Each mine would have the capacity for primary crushing operations. Dust from shale dumping and primary shale crushing inside the mine would be controlled by water sprays. The coarse shale would be hoisted to the surface and transported by covered overland belt conveyors for storage and secondary crushing near the retorting and upgrading facilities. The conveyor would be elevated on steel supports. The overland conveyor would cross Bitter Creek on a steel truss bridge. Conveyor transfer points would be located in Blocks B and C.

Materials Handling System

Two 4.5-mile long belt conveyors would be built to transport oil shale from the mines to a secondary crushing system or storage pile. The conveyors would be partially covered (top and sides) to achieve maximum particulate control. Transfer stations, where coarse ore is transferred from one belt conveyor to another, would be enclosed with the transfer points hooded and vented to pulse-jet type baghouses.

Retorting and Upgrading System

After final crushing the shale would be brought to a processing facility for retorting and upgrading. The processing facility would consist of a TOSCO II retort pyrolysis unit (discussed in the Site-specific Analyses Introduction of this EIS), a fractionation unit, gas recovery and treatment units, delayed coker units, naphtha hydrotreater, gas oil hydrotreater, hydrogen plant, by-product separation unit, sulfur recovery and tail gas unit, intermediate product storage unit, raw wastewater treatment plants, and support facilities.

The retorting and upgrading operations would convert 66,000 tons per day of dry raw shale into usable products and by-products and disposable wastes. After processing, the crude shale oil and by-products would go through the upgrading facilities. The final products would be approximately 44,953 bpsd of shale oil, 3,750 bpsd of LPG, 162 long tpsd of sulfur, 145 short tpsd of ammonia, and 805 short tpsd of coke.

Fuels that would be produced by the plant for internal consumption include treated fuel gas (ethane and lighter) and a liquid stream containing butanes, fuel oil, and diesel oil.

The processed shale would be cooled and moisturized to approximately 13 percent moisture content and transported to the spent shale disposal area.

Product Pipeline

The 44,953 bpsd of hydrotreated shale oil would be transported from the plant site to Rangely, Colorado, via a 12-inch diameter buried pipeline with intermediate valves and one on-site pump station. The pipeline would lie within the general utilities corridor which includes the southern power transmission line and the water pipeline from the White River. It ultimately would parallel the existing Chevron Pipeline Company right-of-way to Rangely, Colorado (Maps T-1-1 and R-A-1, located in Appendix R-A). Approximately 320 acres would be disturbed by construction of the pipeline.

A cathodic protection system would be installed at the time of pipeline construction. The need for operating the cathodic protection system would be evaluated after construction and within the first year of operation. The pipeline would be fitted to facilitate testing and operation of the protection system.

Assuming a rupture would occur at the maximum spill point (where the block valves would be the maximum distance apart or where the driving time to a rupture would be longest), the pipeline could lose a maximum of 5,500 barrels of oil in the event of a rupture on land. The pipeline would cross the White River at three places. Shut-off valves would be located on each bank of the White River crossings. Assuming a worst-case spill at each location, 1,100 to 1,800 barrels of oil could be spilled directly into a river.

A Spill Prevention Control and Countermeasure Plan is required for the pipeline and would contain site-specific spill control and countermeasure plans for all locations, including the river crossings.

Spent Shale Disposal

Approximately 54,000 tpsd (on a dry basis) of spent shale would be generated. The shale would be placed in a disposal area approximately 0.5 mile north-northeast of the processing plant (Map T-1-1). Approximately 2,000 acres would be affected by the disposal area and catchment ponds. However, this total area would not be affected at one time, as the area would be disturbed in stages and reclamed in stages.

The disposal area would be divided by a natural, ephemeral drainage from North Wash, which runs to the White River. This small drainage would receive runoff from 100 acres of surface area upstream of the spent shale area. The spent shale would be kept out of the active floodplain of this drainage and away from any substantial deposits of alluvium that could conduct seepage from the pile.

A system of temporary diversion/catchment ditches and catchment ponds would be used to control runoff and seepage. Seepage cutoff trenches would be installed as necessary in the catchment dams receiving drainage from the spent shale embankment. All dams and impoundments would be designed to retain surface runoff equivalent to that expected to be produced by a precipitation event equivalent to 2 times the 100-year, 24-hour precipitation event (about 5.5 inches of precipitation). The spillways required for safety would be designed to pass high flows up to the 500-year event. As part of the water recycling system, the impounded water would be reused for moisturizing spent shale.

The initial layers of spent shale and all frontal slopes would be compacted to a density of 95 pounds per cubic foot. The remaining interior portions of the pile would be compacted to 85 pounds per cubic foot. The higher density portions of the pile would serve to limit further movement (outside the pile) of any water that might seep into the low permeability embankment.

Fugitive dust from the pile would be controlled by water spraying of areas of the spent shale embankment undergoing further disturbance.

The moisturized spent shale would be transported by covered belt conveyor to a dual truck loading station. If trucks are not available for loading directly from the main conveyor, the spent shale would be directed to a temporary storage pile for subsequent loading by a front-end loader. This pile would be surrounded by earthen berms to ensure that drainage from the pile is not discharged into undisturbed terrain. Water sprays would be used at the spent shale discharge points to control fugitive dust.

The spent shale would be disposed of sequentially in ten segments of the two major piles. Each of the segments would be up to 250 acres in size and would be constructed over a three-year period. Reclamation of the first half of the segment would begin while the second half is being constructed. Thus, the "active" part of the segment would not exceed 125 acres. Refer to the Appendix R-J for reclamation details.

Monitoring of disposal operations would include surface water runoff quality and quantity, water infiltration into the pile, ground water quality, and movement of the embankment. Samples of surface waters and ground waters would be collected and analyzed periodically for potential contaminants. Surface waters would be monitored upstream and downstream of the embankments. Ground water would be monitored upgradient and downgradient of the embankments as well as within the embankment. Mass stability would be monitored visually, with stakes and observation of any unusual surface slumping, while internal movement might be monitored with strain detection devices if internal movement is expected.

Wastewater Treatment System

Wastewaters that would require treatment include raw river water, water from the retorting and upgrading units, process area runoff, and sanitary wastes. The plant site would be graded and stabilized to prevent discharge of water-carried pollutants. All wastewaters would be reused; no discharge of wastewaters to surface drainages is proposed. Some wastewater would be treated and recycled as process water, and some would be used to moisturize spent shale.

Solid and Hazardous Waste Disposal

Large quantities of solid waste materials would be generated over the life of the project. Certain wastes, such as spent catalysts and certain sludges, may require handling as hazardous wastes.

Depending on final characterization under federal and state regulations, wastes would be disposed of either in the hazardous or non-hazardous section of a solid waste facility located in the west half, Section 2, Township 10 South, Range 21 East of the property. Generally, sanitary refuse and other debris generated during construction (2,550 tons/year) and operation would be disposed of in a sanitary landfill. The 12,328 tons/year of sediment from raw water treatment would be used as plant growth medium during reclamation. Oily sludges (2,500 tons/year) would be deposited in a land treatment facility for biological degradation. A storage pond would be used alternately with the land treatment facility, depending on the weather conditions. Spent catalysts

and sludge (1,070.4 tons/year) would be recycled whenever possible, but certain spent catalysts could require disposal in a hazardous waste landfill. The scrap metal or saleable waste would be kept in a controlled area for recycling or sale.

Ancillary Facilities

Access Roads

Three access roads to the plant site would be required (Map T-1-1 and Map R-A-1, located in Appendix R-4). They would follow existing, unpaved roads, in part. The existing roads would be regraded and paved, curves realigned, and culverts and drains installed where necessary. Fugitive dust resulting from construction operations would be controlled by watering high-use areas as required. Proposals regarding specific road construction techniques are contained in the Project Description Technical Report (Tosco 1982).

The eastern access road would extend from the plant site to just east of the Bonanza power plant. This route would provide access to Bonanza, Utah, and Rangely, Colorado, through the added use of Colorado State Route 64. It would also be used to transport heavy equipment from the railhead at Mack, Colorado. This route would require 23 miles of new construction or improvements. Further, a new bridge would need to be constructed across the White River (Section 8, Township 9 South, Range 22 East). This route would disturb 419 acres for the life of the project.

The northern access road would extend southwesterly about 14 miles from the new Vernal-Bonanza road near Red Wash, where it would connect with the eastern access route to the plant site. The entire length would be upgraded. This route would disturb 2515 acres for the life of the project.

The western access road would connect to State Highway 88. It would cross 6.5 miles of the Uintah and Ouray Indian Reservation and 1 mile of BLM land. The route is 12 miles long and would disturb 218 acres for the life of the project.

Interblock Roads and Conveyors

About 7 miles of interblock roads would be required to transport workers and supplies from the main construction and plant site area on Block A to construction and mine support facilities on Blocks B and C (Map T-1-1). The roads would be graveled and maintained for frequent travel at maximum speeds of 25 miles per hour. They would lie within a corridor which would include overland belt conveyors and buried water pipeline, and would disturb about 146 acres for the life of the project. A new steel or reinforced concrete bridge across Bitter Creek would be installed.

Two additional interblock roads for access to the ventilation shafts on Blocks D and H would be upgraded and graveled along existing routes (Map T-1-1). These roads would require a maximum 120-foot wide right-of-way depending upon slope requirements for cuts and fills. After construction, these roads would be reduced to narrow-width service roads for use of infrequent, light-vehicle traffic.

Water Supply System

Approximately 9,000 ac-ft/yr of water would be required for the Tosco project. This water would be purchased from the State of Utah at the proposed White River Dam. It would be released and withdrawn 11 miles downstream (Section 28; Township 9 South, Range 22 East). The water pipeline would be near the power transmission line and product pipeline in order to share a common corridor (Map T-1-1 and Map R-A-1 located in Appendix R-A).

The water supply system would consist of a water intake and pump station along the White River northeast of the Block A plant site, a buried pipeline from the intake and pump station to the plant site, and a raw water storage reservoir (to provide a 30-day emergency water supply) located immediately south of the oil shale processing facility. Water to the other facilities would be supplied from the Block A plant site by a pipeline paralleling the overland conveyor and interblock roads.

The water intake structure would be a direct river diversion with a screening device that would exclude 3-inch and larger material.

The pipeline right-of-way between the main facility and the White River would be 5.9 miles long and would disturb approximately 41 acres during 1 year of construction. No intermediate pump stations would be required along the proposed route.

Power Supply System

To ensure reliability of electric power to the project site, two separate 138-kV power transmission lines from the Bonanza Power Plant would be constructed. Each would be capable of delivering 100 percent of the project's ultimate electrical requirements. These lines (a northern line and a southern line) would be routed through separate corridors to provide maximum reliability should one line fail (Map T-1-1 and Map R-A-2, located in Appendix R-A). The combined length of the lines would be 43 miles; 157 acres would be disturbed for 2 years before reclamation.

All power transmission lines would conform to Rural Electric Association (REA) standards to protect birds against electrocution. The transmission line terminals would be fenced and appropriate 138-kV terminating facilities installed.

T-1.E **ALTERNATIVES**

T-1.E.1 SHALE OIL UPGRADING ALTERNATIVE

This processing alternative would involve modification of the process plant with the addition of a Flexicoking unit, a fluid catalytic cracking unit, a diesel hydrotreating unit, and a naphtha reformer. The products would be gasoline and diesel fuel, in addition to smaller amounts of coke, sulfur, and ammonia. The pyrolysis units would be the same as for the proposed project. Fractionation and gas oil hydrotreating would be slightly reduced in size,

while gas recovery and the naphtha hydrotreating units would be increased. The diesel hydrotreater unit would function as would the naphtha and gas oil hydrotreaters, except that no arsenic guard reactors would be required, since the arsenic would have been removed upstream in the process flow.

Instead of a delayed coker, this gasoline/diesel alternate would utilize a Flexicoker, which would differ from delayed coking by producing less coke. The Flexicoker would produce a low-Btu fuel gas used as a portion of the fuel for the hydrogen plant reformer.

The fluid catalytic cracker would be a continuous cracking and regenerative process that converts heavy gas oil fed from the gas oil hydrotreater into a full range of distilled products. The naphtha reformer would convert light, straight-chain paraffins into longer-chain isomerized hydrocarbons and aromatics. These would be used to produce a gasoline blending stock that has a high octane content. The reformer would need a series of fixed bed reactors that contain platinum catalysts on alumina or silica alumina carriers.

This alternative would use about 8,886 ac-ft/yr of river water. Power requirements would be 198 megawatts.

Because of the increase in physical size of units of the processing plant, 1,123 acres would be disturbed during plant construction. The size of the construction and operation work force would be expected to increase by 10 percent over that of the proposed project. This would bring peak construction personnel to 4,562 and peak operation personnel to 2,563. In addition, the overall project construction schedule would be expected to be extended by about 9 months.

Sulfur oxides emissions from the processing units would be 97 kg/hr to 153 kg/hr; carbon monoxide rates would be 11 kg/hr. Liquid wastes would be the same as for the proposed action. Solid wastes (sediment) derived from treatment of raw process waters would be about 13,000 tons per year.

Under this alternative, it would be possible to transport the gasoline and diesel fuel from the plant by truck. The gasoline and diesel fuel could be transported by common carrier to distribution points in the area, such as Salt Lake City.

T-1.E.2 WHITE RIVER SECTION 17 ALTERNATIVE WATER SUPPLY SYSTEM

This alternative would be similar to the proposed water supply system except water would be diverted from the White River in Section 17 (Township 9 South, Range 22 East), in the vicinity of the Mountain Fuel Bridge. The system would use the same type of diversion structure and pumping station. The water pipeline would be 6 miles long; 47 acres would be disturbed for 1 year during construction. Its location is shown on Map R-A-2, located in Appendix R-A. Approximately 2 miles of the pipeline would cross the Uintah and Ouray Indian Reservation.

T.1.E.3 GREEN RIVER SECTION 23 ALTERNATIVE WATER SUPPLY SYSTEM

This alternative would involve a river diversion, pump station, and pipeline to the site similar to those of the proposed project, but the point of diversion would be from the Green River in Section 23 (Township 9 South, Range 19 East). Construction methods would also be the same. The pipeline would be 13 miles long; 94 acres would be disturbed for 1 year during construction. The location of this alternative is shown on Map R-A-2, located in Appendix R-A. Approximately 8 miles of the pipeline would cross the Uintah and Ouray Indian Reservation.

T-1.E.4 WHITE RIVER DAM ALTERNATIVE WATER SUPPLY SYSTEM

This alternative would involve a river diversion, pump station, and pipeline to the plant site similar to those of the proposed project except that water would be withdrawn directly from the proposed White River Reservoir. Direct withdrawal of water from the reservoir would lower sediment concentration, offer a more dependable water supply, and be less susceptible to large variations in water flow and levels. The alternative pipeline would be 19-miles long; 140 acres would be disturbed for 1 year during construction. The location of the water pipeline is shown on Map R-A-2, located in Appendix.

T-1.E.5 INTERBLOCK CORRIDOR WHITE RIVER DAM ALTERNATIVE WATER SUPPLY SYSTEM

This alternative would involve the same components as the White River Dam Alternative Water Supply System (Section T-1.E.4); however, the route would be different (Map R-A-2, located in Appendix R-A). To the extent possible, this alternative would lie within Tosco's proposed interblock corridor. The pipeline would be 18.8 miles long; 139 acres would be disturbed for 1 year during construction.

T-1.E.6 NORTH ROUTE ALTERNATIVE TRANSMISSION LINE

This alternative power transmission line route would be similar to the proposed route in that it would provide for two lines routed through separate corridors, each capable of carrying the full demand load. The northern line of this alternative would be the same as the northern line of the proposed transmission system; the other line would extend north from the plant site to the Deseret utility corridor (Map R-A-2, located in Appendix R-A). The total length of the alternative lines would be 46 miles; 169 acres would be disturbed for 2 years during its construction. About 6.5 miles of the northern line would cross the Uintah and Ouray Indian Reservation.

T-1.E.7 SALT LAKE CITY ALTERNATIVE PRODUCT PIPELINE

Under this alternative, the upgraded shale oil would be transported to Salt Lake City rather than Rangely, Colorado (Map T-1-2, located in Appendix R-A). The alternate route would be adjacent to the existing Chevron pipeline right-of-way. It would require approximately 160 miles of 12-inch diameter pipeline, 3 pump stations, and up to 52 river or canal crossings (see Table T-1-2 for land status by milepost). Approximately 1,254 acres would be disturbed for 2 years during construction.

The alternative would be built by three construction crews totaling 100 persons. The product pipeline could be constructed within 24 months but due to winter conditions, the construction period would be divided into two 7-month periods--April through October.

Construction would generate 716 truckloads (40 tons) carrying pipe to be spread throughout the entire length of the project. The pipe would be hauled from Provo, Utah, and would travel Highways 15, 189, 40, and 88.

Approximately 180 road trips would be generated each day from the construction spreads (100 men) and 24 trips would be generated by the moving of the equipment for construction.

Proposed pump station locations are shown on Map T-1-2. One would be located at the Sand Wash plant site (as with the proposed route). A second pump station would be located in the vicinity of Chevron Pipeline Company's Myton Pumping Station (south of Myton) at an elevation of 5,300 feet. The third station would be located about 2 mile west of Chevron's Hanna Station (north of Duchesne) at an elevation of 6,900 feet.

The 60-foot wide right-of-way would also involve three railroad crossings, two interstate highway crossings, and nine other major highway crossings. Major highways would be crossed by boring under them wherever geologic, topographic, and engineering considerations dictate. At these crossings, the pipeline would be buried to a depth adequate to protect the pipeline from expected loadings.

The pipeline would be equipped with two pressure control stations located within the pipeline right-of-way. One would be located near the pipeline's intersection with U.S. Highway 40 at an elevation of 6,900 feet (Milepost 141). The other pressure control station would be located at the pipeline terminus upstream of the storage tanks at Salt Lake City (Milepost 159). The pump stations, pressure control stations, and terminus facilities would be unmanned. These would be monitored at the Sand Wash plant site control station.

Section valves would be located at 10-mile intervals as planned for the proposed project, and each river crossing would have block valves at each bank. Construction activities and methods would be the same as those of proposed project (Section T-1.D.2, Ancillary Facilities).

Additional construction and mitigation details are included in the <u>Salt Lake City Alternative - Tosco Shale Oil Product Pipeline Technical Report</u> (BLM and USFS 1982)

TABLE T-1-2

SALT LAKE CITY ALTERNATIVE PRODUCT PIPELINE
LAND STATUS BY MILEPOST

County	Milepost	Status Ownership	Length (Miles)
Uintah	0 - 2.0	S	2.0
	2.0 - 6.4	I	4.4
	6.4 - 6.8	P	0.4
	6.8 - 7.1	I	0.3
	7.1 - 7.8	P	0.7
	7.8 - 9.8	I	2.0
	9.8 - 11.5	I	1.7
	11.5 - 12.1	P	0.6
	12.1 - 12.6	I	0.5
	12.6 - 13.4	P	0.8
	13.4 - 18.2	I	4.8
	18.2 - 19.2	FWS	1.0
	19.2 - 20.6	I (leased to FWS)	1.4
	20.6 - 21.1	FWS	0.5
	21.1 - 22.3	BLM	1.2
	22.3 - 23.2	P	0.9
	23.2 - 24.1	BLM	0.9
	24.1 - 26.1	I	2.0
	26.1 - 26.5	P	0.4
	26.5 - 27.1	I	0.6
	27.1 - 28.2	P	1.1
	28.2 - 28.6	I	0.4
	28 6 - 34.4	P	5.8
	34.4 - 38.6	I	4.2
	38.6 - 38.8	P	0.2
Duchesne	38.8 - 40.4	P	1.6
	40.4 - 41.9	I	1.5
	41.9 - 47.2	P	5.3
	47.2 - 47.5	I	0.3
	47.5 -47.9	P	0.4
	47.9 - 49.2	I	1.3
	49.2 - 66.9	P	17.7
	66.9 - 67.1	I	0.2
	67.1 - 67.5	IA	0.4
	67.5 - 67.7	I	0.2
	67.7 - 67.9	P	0.2
	67.9 - 68.4	I	0.5
	68.4 - 68.5	IA	0.1

TABLE T-1-2 (continued)

SALT LAKE CITY ALTERNATIVE PRODUCT PIPELINE
LAND STATUS BY MILEPOST

County	Milepost	Status Ownership	Length (Miles)
Duchesne (con't)	68.5 - 75.9	P	7.4
	75.9 - 76.2	I	0.3
	76.2 - 77.9	P	1.7
	77.9 - 78.2	IA	0.3
	78.2 - 78.5	P	0.1
	78.5 - 78.6	I	0.3
	78.6 - 78.9	IA	0.3
	78.9 - 79.7	I	0.8
	79.7 - 79.9	P	0.2
	79.9 - 80.5	I	0.6
	80.5 - 80.9	P	0.4
	80.9 - 81.2	IA	0.3
	81.2 - 81.9	P	0.7
	81.9 - 82.0	I	0.1
	82.0 - 82.4	P	0.4
	82.4 - 82.7	I	0.3
	82.7 - 83.9	P	1.2
	83.9 - 84.3	I	0.4
	84.3 - 84.4	P	0.1
	84.4 - 84.7	I	0.3
	84.7 - 94.9	P	10.2
Wasatch	94.9 - 95.4	P	0.5
	95.4 - 109.0	FS	13.6
	109.0 - 109.9	P	0.9
Summit	109.9 - 110.9	P	1.0
Wasatch	110.9 - 112.3	P	1.4
	112.3 - 112.6	FS	0.3
	112.6 - 115.4	P	2.8
Summit	115.4 - 125.5	P	10.1
Wasatch	125.5 - 127.9	P	2.4
Summit	127.9 - 138.4	P	10.5
Salt Lake	138.4 - 139.4	FS	1.0
	139.4 - 143.2	P	3.8
	143.2 -143.8	FS	0.6
	143.8 - 147.4	P	3.6

TABLE T-1-2 (concluded)

SALT LAKE CITY ALTERNATIVE PRODUCT PIPELINE
LAND STATUS BY MILEPOST

County	Milepost	Status Ownership	Length (Miles)
Salt Lake (con't)	147.4 - 148.1	FS	0.7
	148.1 - 152.3	P	4.2
	148.1 - 152.3	P	4.2
	152.3 - 152.7	FS	0.4
	152.7 - 152.9	P	0.2
	152.9 - 153.3	FS	0.4
	153.3 - 155.1	P	1.8
	155.1 - 155.8	FS	0.7
	155.8 - 156.9	P	1.1
	156.9 - 158.0	P	1.1
Davis	158.0 - 160.0	P	2.0

Note: BLM = Bureau of Land Management
FS = Forest Service
FWS = Fish and Wildlife Service
I = Indian
IA = Indian Allotted
P = Private
S = State

T-1.E.8 ALTERNATIVE ACCESS ROADS

This alternative would involve the same origins and destinations as the three proposed action access roads; however, the routes of two of the roads (east and north) would be different (Map R-A-2, located in Appendix R-A). The east access road would be 23 miles long and would extend from Bonanza, Utah, through the Chapita Wells gas field, over the Mountain Fuel bridge to the plant site. Five miles of this road would cross the Uintah and Ouray Indian Reservation. The north access road would extend 14 miles from the new Vernal-Bonanza road near Red Wash to the Mountain Fuels bridge, where it would connect with the east access road to the plant site. The entire length would be upgraded, including the 2.5 miles on the Uintah and Ouray Indian Reservation. The west access road would be 11 miles long and would cross 6.5 miles of the Uintah and Ouray Indian Reservation. (Even though the west access road would follow the same route as the proposed action west access road, it would be 1 mile shorter because the point where it would tie to the main access road would be different.) A total of 888 acres would be disturbed during construction of the three roads.

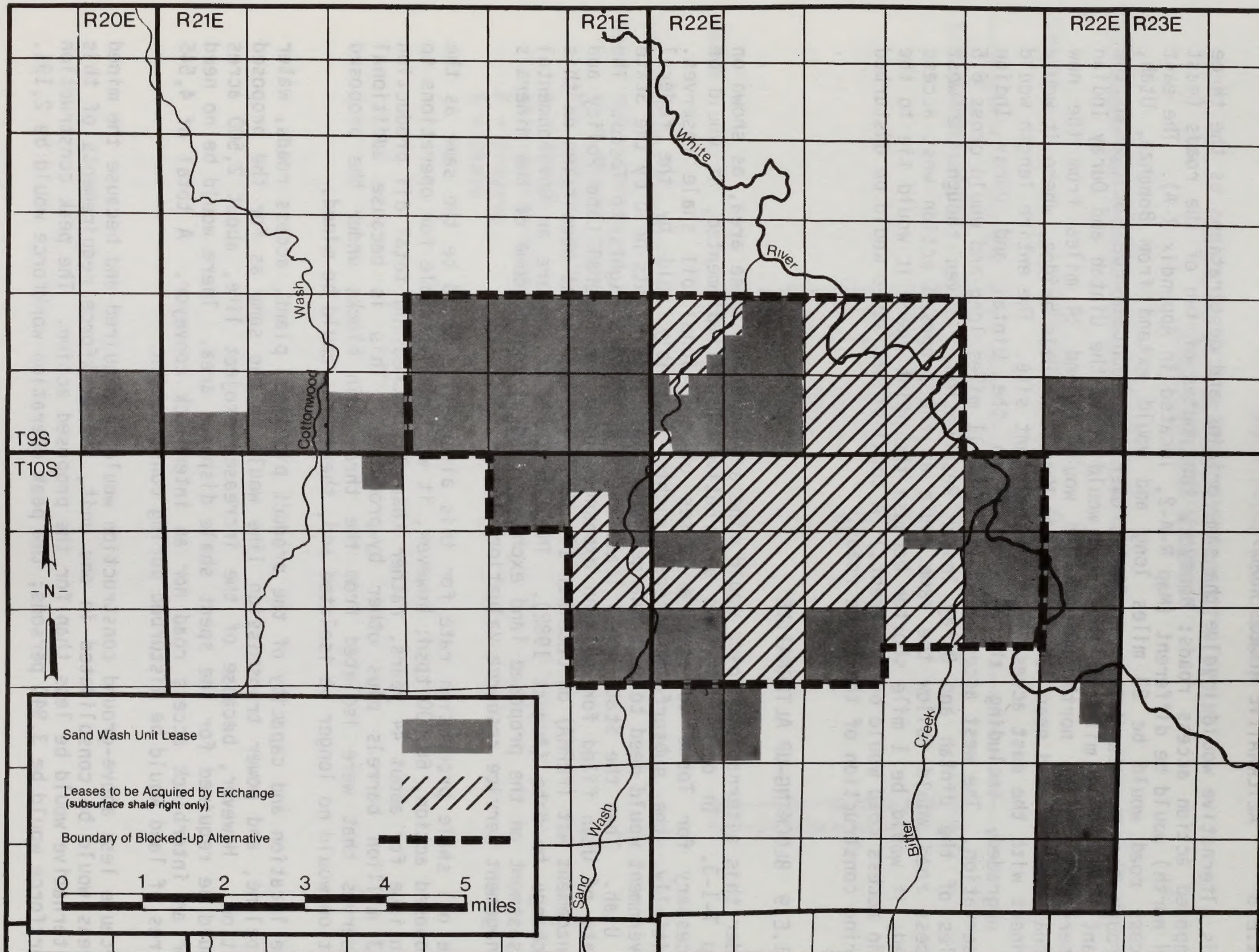
T-1.E.9 BLOCKING-UP ALTERNATIVE

Under this alternative, Tosco would mine a blocked-up lease area, as shown on Map T-1-3. In order for this alternative to be implemented, it would be necessary for Tosco to acquire leases of additional oil shale reserves. Initially, the subsurface mineral rights currently held by the federal government would need to be exchanged with subsurface rights held by the State of Utah. Then the State could lease these subsurface rights to Tosco. The State of Utah filed for such an exchange under the Federal Land Policy and Management Act (FLPMA) on December 19, 1981. No action has been taken on this exchange to date (August 1982). The BLM plans to prepare an Environmental Assessment on the proposed land exchange pending the outcome of the Minerals Management Service resource valuation studies.

The oil shale production rate for this alternative would be the same as the proposed action, 66,000 tpsd; however, it would be possible for operations to continue for about 44 years, rather than 35, increasing total oil production 143 million barrels plus other by-products. This is because additional reserves that were isolated from the three main blocks under the proposed action would no longer be isolated and, therefore, could be mined.

The location and capacity of the product pipeline, plant, access roads, water pipeline, and power transmission line would be the same as for the proposed action. However, because of the increased project life, about 2,500 acres would be required for the spent shale disposal area. There would be no need for an interblock access road nor an interblock conveyor. A total of 4,545 acres of land would be disturbed during construction.

Because less above-ground construction would be required and because the mined areas would be consolidated in one unit, the workforce requirements of this alternative would be less than for the proposed action. The peak construction workforce would be 3,940 persons; the peak operation workforce would be 2,191.



MAP T-1-3 TOSCO BLOCKING-UP ALTERNATIVE

T-1.E.10 NO-ACTION ALTERNATIVE

The No-Action Alternative would involve the denial of requested rights-of-way for access roads, interblock roads and conveyors, water pipeline, product pipeline, transmission line, and underground tunnels (refer to the No-Action Alternative section of the Site-Specific Analyses Introduction of this EIS for additional explanation of the purpose of this alternative). Without these rights-of-way, Tosco would not be able to develop its proposed project.

T-1.E.11 ALTERNATIVES CONSIDERED BUT ELIMINATED FROM DETAILED ANALYSIS

Shale Oil Upgrading Alternatives

Five shale oil upgrading process variations were considered but eliminated from detailed analysis. These alternatives are identified in the Project Description Technical Report (Tosco 1982) as Alternate I: Six Train Raw Shale Oil (no hydrotreating) (Section 12); Alternate II: Six Train Pyrolysis and Hydrotreating - Fluid Coker (Section 12); Alternate III: Six Train Pyrolysis and Hydrotreating - "Flexicoking" (Section 12); Alternate IV: Six Train Pyrolysis - Whole Oil Hydrotreating; and Alternate VII: Six Train Pyrolysis and Hydrotreating - Natural Gas-Fired Hydrogren Unit (Section 12). These alternatives were not analyzed in detail, because their environmental impacts would lie within the range of impacts analyzed for the proposed project (minimum impacts) and the Shale Oil Upgrading Alternative (maximum impacts). All would have emissions, solid waste, and power usage values which were more than the proposed project but less than the alternative.

Water Supply Systems

Various water supply systems utilizing alluvial well fields in both the Green and White rivers were analyzed but eliminated from further study. Well field locations studied would not be viable options because the soils and overburden along the rivers would make construction difficult and the discontinuous nature of the sand and gravel would not yield the volumes of water required for the project.

The Green River diversion from Section 5 (identified as Water supply alternate II in the technical report (Tosco 1982)) was not analyzed in detail, because a similar diversion from Section 23 was analyzed. The diversion from Section 23 would be 4 miles longer but otherwise identical to the Section 5 route.

Two additional alternatives were identified in the technical report (Alternate V: DG&T pipeline via Section 28; and Alternate VI: DG&T pipeline via Section 17). They would involve purchase of water from DG&T and transporting it from the Bonanza Power Plant to the Tosco plant site via a buried pipeline originating in Section 28 or Section 17. They were eliminated from detailed analysis, because DG&T would only be able to supply water for the project for about 5 to 6 years (BLM 1981c). Therefore, these are considered by the BLM to be only temporary water supply systems.

Mining and Materials Handling

The mining and materials handling alternates I, II, and III identified in the Project Description Technical Report (Tosco 1982) were eliminated from detailed analysis, because they assume acquisition of additional land through land purchase, lease aquisition, or lease exchange and there is no evidence of firm plans for acquisition (such as letters of intent from the affected land or lease holders).

Product Pipeline

The product pipeline alternate II identified in the Project Description Technical Report (Tosco 1982) was eliminated from detailed analysis, because its north-south segment would be the same as the first segment of the Salt Lake City Product Pipeline Alternative (analyzed in detail in the technical report which supports this EIS (BLM and FS 1982)) and the east-west segment would be the same as the proposed pipeline route except for 2 miles. The impacts resulting from disturbing these 2 miles were not considered significantly different from those analyzed for the proposed route.

Access Roads

The access road alternates I and II identified in the Project Description Technical Report (Tosco 1982) were eliminated from detailed analysis, because they are minor variations on the proposed route and represent differences of about 1 mile in the final alignment of the right-of-way. They would lie within the one-mile corridor analyzed for the proposed route. The minor differences in the amount of upgrading proposed under the alternates would not significantly change the impacts identified for the proposed route. Because the proposed route assumes general upgrading along its entire length, it represents a worst-case analysis.

Alternate III identified in the technical report was analyzed and it was found that less disturbance and fewer potential problems would arise if all construction were done at a single river crossing point.

T-1.F **DATA SUMMARY**

Various aspects of the proposed Tosco project and alternatives (where applicable) are summarized in Table T-1-3, Magnitude and Duration of Land Disturbance; Table T-1-4, Personnel Requirements; Table T-1-5, Resources Consumed and Produced During Operation; Table T-1-6, Total Controlled Emissions; and Table T-1-7, Solid Waste Generated During Construction and Operation.

TABLE T-1-3

MAGNITUDE AND DURATION OF LAND DISTURBANCE

Component	Length (miles)	Construction Width/Size	Operation Width/Size	Maximum Disturbed Acres/Duration[b]	Removed Acres/Duration	Reclaimed Acres
PROPOSED ACTION						
Mine and Plant	NA	NA	NA	1,086/1 year	746/35 years	340
Spent Shale Disposal Area	NA	NA	NA	2,000/35 years		2,000/35 years
Retention Ponds	NA	NA	NA	214/35 years	0	214
Access Roads East	23	150 ft	70 ft	419/1 year	195/35 years	224
North	12	150 ft	70 ft	218/1 year	102/35 years	116
West	14	150 ft	70 ft	251/1 year	117/35 years	134
Interblock Roads, Vent Shaft Roads, Conveyors	22.7	60-175 ft	30-80 ft.	298/1 year	202/35 years	96
Product Pipeline	42	60 ft	50 ft	320/2 years	0	320
Water Pipeline	5.9	60 ft	50 ft	41/1 year	0	41
Power Transmission Line	43	20 ft road 50-ft radius/pole	20 ft	157/2 years	0	157
Communication System			No Additional Acreage Required			
Construction Camp	NA	NA	NA	150 years	0	150
Total				5,154	1,362	3,792
ALTERNATIVES						
Shale Oil Upgrading[a]	NA	NA	NA	1,123/1 year	783/35 years	340
White River Section 17 Water Supply System	6	60 ft	50 ft	47/1 year	0	47
Green River Section 23 Water Supply System	13	60 ft	50 ft	94/1 year	0	94
White River Dam Water Supply System	19	60 ft	50 ft	140/1 year	0	140
Interblock Corridor White River Dam Water Supply System	18.8	60 ft	50 ft	139/1 year	139/35 years	139
North Route Power Transmission Line	46	20 ft road 50-ft radius/pole	20 ft	169/2 years	0	169
Salt Lake City Product Pipeline	160	60 feet	60 feet	1,254/2 years	6 /35 years	1,248
Access Roads East	21	150 ft	70 ft	387/1 year	181/35 years	206
North	14	150 ft	70 ft	262/1 year	122/35 years	140
West	11	150 ft	70 ft	251/1 year	117/35 years	134

TABLE T-1-3 (Concluded)

MAGNITUDE AND DURATION OF LAND DISTURBANCE

Component	Length (miles)	Construction Width/Size	Operation Width/Size	Maximum Disturbed Acres/Duration	Removed Acres/Duration	Reclaimed Acres
ALTERNATIVES (Con't)						
Blocking-Up						
Mine and Plant	NA	NA	NA	489/1 year	379/40 years	110
Spent Shale Disposal Area/Retention Ponds	NA	NA	NA	2,500/40 years	0	2,500
Access Roads						
Eastern	23	150 ft	70 ft	419/1 year	195/40 years	224
Northern	12	150 ft	70 ft	218/1 year	102/40 years	116
Western	14	150 ft	70 ft	251/1 year	117/40 years	134
Product Pipeline	42	60 ft	50 ft	320/1 years	0	320
Water Pipeline	5.9	60 ft	50 ft	41/1 year	0	41
Power Transmission Line	43	20 ft road 50-ft radius/pole	20 ft	157/1 years	0	157
Communication System			No Additional Acreage Required			
Construction Camp	NA	NA	NA	150/3 years	0	150
Total				4,545	793	3,752

NA = not applicable
[a]Corresponds to acreage that would be required for the mine and plant if this alternative were implemented.
[b]Maximum disturbed duration equals maximum duration and/or active land use.

TABLE T-1-4

PERSONNEL REQUIREMENTS[a]

Year	Construction Work Force	Operation Work Force	Total Work Force
1983	180	25	205
1984	740	330	1,070
1985	2,535	510	3,045
1986	3,460	665	4,125
1987	1,850	1,340	3,190
1988	230	2,070	2,300
1989	115	2,185	2,300
1990-2000[b]	0	2,185	2,185

[a]Work force estimates are based on an average per year. These numbers are expected to be within plus or minus 25 percent of the actual numbers. The actual numbers would vary as a function of shift scheduling and productivity.

[b]Totals per year.

TABLE T-1-5

RESOURCES CONSUMED AND PRODUCED DURING OPERATION

Resource Consumed	Amount	Resource Produced	Amount
Oil Shale	66,000 tpsd	Shale Oil	44,953 bpsd
Water	9,000 ac-ft/yr		
Power	201 MW/day	By-Products	
		Liquefied Petroleum Gas	3,750 bpsd
		Sulfur	162 long tpsd
		Ammonia	145 tpsd
		Coke	805 tpsd

tpsd = tons per stream day
bpsd = barrels per stream day
ac-ft/yr = acre-feet per year
MW/day = megawatts per day

TABLE T-1-6

TOTAL CONTROLLED EMISSIONS

Pollutant	Emissions Rate (kilograms per hour) Proposed Project	Emissions Rate (kilograms per hour) Shale Oil Upgrading Alternative
Total Suspended Particulates	120	116
Sulfur Oxides	94	97
Nitrogen Oxides	786	808
Carbon Monoxide	9	11
Hydrocarbons	183	140

TABLE T-1-7

SOLID WASTE GENERATED DURING CONSTRUCTION AND OPERATION

Waste Material	Source	Estimated Quantity (ton/yr)	Estimated Volume (cubic yard/year)
	Sanitary Landfill		
Solid Waste	Raw Water Treatment	12,328	34,500
Sanitary Refuse	Mine and plant site	3,000	8,500
Construction Debris	Mine and plant site	2,500	7,000
Total		17,828	50,000
	Hazardous Wastes		
Spent Catalysts			
Spent HDN catalysts	Upgrading Units	305	500
Guard bed catalysts (proprietary solids)	Upgrading Units	580	900
Spent HDS catalyst	Hydrogen Unit (hydrodesulfurizer)	18.3	35.9
Spent ZnS catalyst	Hydrogen Unit (ZnO guard bed reactor)	6.7	17.9
Spent Fe-Cr catalyst	Hydrogen Unit (high temp shift converter)	14.2	25.4
Spent Cu-Zn catalyst	Hydrogen Unit (low temp shift converter)	33.7	54.4
Spent reforming catalyst	Hydrogen Unit (reformers)	12.8	19.8
Spent methanation catalyst	Hydrogen Unit (methanation)	5.4	8.4
Spent alumina catalyst	Sulfur Unit	80	100
Spent sludge (DEA Filtration)	Gas recovery	14.25	12.6
Total		1,070.4	1,674.4
Others			
Separator sludge	API separator	500	720
Tank Bottom sludge	Water treatment area	2,000	2,400
Contaminated plant debris	Mine and plant site	50	200
Total		2,550	3,320

COMPARATIVE ANALYSIS OF PROPOSED ACTION AND ALTERNATIVES

The Tosco Sand Wash Project proposed action (a complete system) and alternative (component and process) are compared in this chapter. Various component and process alternatives and components of the proposed action can be assembled into a range of complete system alternatives. Tables T-2-1 and T-2-2 provide a comparative analysis of significant quantifiable impacts of the proposed action and the alternatives that would result if the Tosco project is implemented. Unavoidable adverse impacts listed in the table are negative environmental impacts that would remain despite mitigation efforts. Adverse impacts which are of low significance or of very short duration are not included.

The "No-Action" alternative is not included in the comparison. With this alternative, the project would not be constructed and the impacts associated with the proposal or the other alternatives would not occur.

TABLE T-2-1

SUMMARY COMPARISON OF IMPACTS BETWEEN PROPOSED ACTION AND WATER ALTERNATIVES

Environmental Element*	Proposed Action	White River S. 17 Alternative Water Supply System	White River Dam Alternative Water Supply System	Interblock Corridor White River Dam Alternative Water Supply System	Green River S. 23 Alternative Water Supply System
Socioeconomics	9,675 employees 7,012 construction population increase 9,531 operating population increase	**	**	**	**
Water Resources	9,000 ac-ft/yr less flow in the White River (1.8% of avg. ann. flow)	**	**	**	9,000 ac-ft/yr less flow in the Green River (0.2% of avg. ann. flow)
Vegetation, Soils, and Reclamation	4,940 ac disturbed 186 ac occupied without reclamation for project life	6 ac more disturbed	99 ac more disturbed	99 ac more disturbed	53 ac more disturbed
Wildlife	4,940 ac disturbed habitat 186 ac occupied without reclamation for project life	6 ac more disturbed habitat	99 ac more disturbed habitat	99 ac more disturbed habitat	53 ac more disturbed habitat
Agriculture	329 AUMs less grazing 1,543 ac cropland including 463 ac prime agricultural land affected	**	6 AUMs less grazing	6 AUMs less grazing	3 AUMs less grazing
Recreation	4,940 ac disturbed recreation land base 13 mi of White River Wild and Scenic River consideration affected	1 mi of White River Wild and Scenic River consideration affected	**	**	1 mi of Green River Wild and Scenic River consideration affected
Visual Resources	70 ac VRM Class II and 27 ac VRM Class III affected	**	18 ac more in VRM Class II and 3 ac more in VRM Class III affected	3 ac more in VRM Class III affected	6 ac more in VRM Class IV affected
Land Use Plans	9 mi outside BLM proposed planning corridor	2 mi more outside BLM proposed planning corridor	12 mi more outside BLM proposed planning corridor	2 mi more outside BLM proposed planning corridor	
	1 mi within White River protected zone	1/2 mi less within White River protected zone	2 mi more within White River protected zone	2 mi more within White River protected zone	1/2 mi less within White River protected zone
		2 mi more within Uintah and Ouray Indian Reservation			8 mi more within Uintah and Ouray Indian Reservation

NOTE: Figures are the projected change to baseline due to development of the Tosco project.

When "more" or "less" appears in the description of the alternative impacts, impacts are being compared to comparable components or processes of the proposed action.

ac = acres; ac-ft/yr = acre-feet per year; AUMs = animal unit months; VRM = Visual Resources Management.

*Only those elements that have impacts that vary significantly from the proposed action are shown.

**Where no entry is made for an alternative, the impact would not vary significantly from that of the proposed action.

TABLE T-2-2

SUMMARY COMPARISON OF IMPACTS BETWEEN PROPOSED ACTION AND SHALE OIL UPGRADING, SALT LAKE CITY PRODUCT PIPELINE, ACCESS ROADS, BLOCKING-UP, AND NO-ACTION ALTERNATIVES

Environmental Element*	Proposed Action	Shale Oil Upgrading Alternative	North Route Alternative Power Transmission Line	Salt Lake City Alternative Product Pipeline	Alternative Access Roads	Blocking-Up Alternative
Socioeconomics	9,675 employees 7,012 construction population increase 9,531 operating population increase	772 more construction workers and a 1,170 (+17.9%) increase in population. 378 more operating workers and 1,150 (+17.0%) increase in population	**	50 more workers for 1 1/2 months	**	207 fewer construction workers and 139 fewer operating workers
Air Quality		59 kg/hr more SO_2 which consumes 1 more PSD increment and 1% more of the NAAQS 18 kg/hr less TSP 35 kg/hr more NO_x 44 kg/hr less THC 25 kg/hr more CO	**	**	**	**
Vegetation, Soils and Reclamation	4,940 ac disturbed 186 ac occupied without reclamation for project life	**	12 ac more disturbed	928 ac more disturbed 6 ac more occupied without reclamation for project life	12 ac more disturbed 6 ac more occupied without reclamation for project life	69 ac less disturbed
Wildlife	4,440 ac disturbed habitat 186 ac occupied without reclamation for project life	**	12 ac more disturbed habitat	928 ac more disturbed habitat 6 ac more occupied without reclamation for project life	12 ac more disturbed habitat 6 ac more occupied without reclamation for project life	69 ac less disturbed habitat
Agriculture	329 AUMs less grazing 1,543 ac cropland affected 463 ac prime agricultural land affected	**	1 AUM less grazing	278 AUMs less grazing 334 ac more cropland affected. 179 ac more prime agricultural land affected	1 AUM less grazing	**
Transportation Networks	U.S. 40 reduced to E level of service	**	**	**	3 mi less road constrution	**
Recreation	9,940 ac disturbed recreation land base 13 mi of White River Wild and Scenic River consideration affected	**	**	Increased resources damage by vehicles caused by undesirable access	**	**
Visual Resources	70 ac VRM Class II and 27 ac VRM Class III affected	**	3 ac more in VRM Class II and 7 ac less in VRM Class III affected	16 ac more of BLM Class II, 9 ac more of VRM Class III, and 29 ac more of VRM Class IV affected	**	**
Land Use Plans	9 mi outside BLM proposed planning corridor 1 mi within White River protected zone	**	6.5 mi more within Uintah and Ouray Indian Reservation	22.6 mi more within Uintah and Ouray Indian Reservation	8 mi more within Uintah and Ouray Indian Reservation	**
Oil Production	35 year project life and oil production of 517 million barrels plus other byproducts	**	**	**	**	Increase life of operatin 9 years and increases oil production 143 million barrels plus other byproducts

NOTE: Figures are the projected change to baseline due to development of the Tosco project.

When "more" or "less" appears in the description of alternative impacts, impacts are being compared to comparable components or processes of the proposed action.

ac = acres; AUMs = animal unit months; CO = carbon monoxide; kg/hr = kilograms per hour; mi = miles; NAAQS = National Ambient Air Quality Standards; NO_x = nitrogen oxides; PSD = Prevention of Significant Deterioration; SO_2 = sulfur dioxide; TSP = total suspended particulates; THC = total hydrocarbons; VRM = Visual Resource Management.

*Only those elements that have impacts that vary significantly from the proposed action are shown.

**Where no entry is made for an alternative, the impact would not vary significantly from that of the proposed action.

The affected environment for the Tosco Sand Wash Project is that part of the existing environment that would be affected by the proposed action (including all project components identified in Chapter T-1) or alternatives. The effects of the project components and the construction and operation work forces on the environment were analyzed for the same resources as identified for the regional analysis (Chapter R-3, Introduction). This chapter provides information only about the environment that would be significantly affected by the Tosco project as determined by the impact analysis presented in Chapter T-4. Analysis indicated that no Wilderness Areas or any areas under formal wilderness review, study, or appeal would be directly or indirectly affected by the development of the Tosco project. Therefore, descriptions of the wilderness resource was not included.

T-3.A **PROPOSED ACTION**

T.3.A.1 SOCIOECONOMICS

The Tosco project would affect Uintah and Duchesne counties in Utah. Because of the close proximity of the project to the Uintah and Ouray Indian Reservation, the reservation also would be affected. The Colorado area (Moffat and Rio Blanco counties) would not be significantly affected. The Tosco development would affect Vernal, Roosevelt, Myton, Ballard, Dinosaur and Rangely. A description of the existing and future baseline environment for the affected areas, including the Uintah and Ouray Indian Reservation, is found in Section R-3.A.1, Socioeconomics.

T-3.A.2 AIR QUALITY

The Tosco site would be located south of the White River and east of the Green River at 5,000 feet mean sea level (MSL). Drainage flows are to the north towards the White River. Estimated baseline pollutant concentrations are shown in Table T-4-2, (Section T-4.A.2). Baseline total suspended particulate levels are predicted to violate the National Ambient Air Quality Standards (NAAQS) due mainly to dust from traffic on unpaved roads and soil particles suspended during high wind conditions. Visibility measurements taken at Dinosaur National Monument are presented in Section R-3.A.2, Air Quality.

T-3.A.3 WATER RESOURCES

Descriptions of the surface water, floodplains, and ground water that would be affected by the Tosco project are included in Section R-3.A.3, Water Resources.

T-3.A.4 VEGETATION, SOILS, AND RECLAMATION

All elements of the proposed action fall within the desert biome and mixed-desert shrub vegetation type. Refer to Section R-3.A.4, Vegetation and Soils, for generalized description of the vegetation. Vegetation cover is sparse and generally forms a ground cover of 8 to 20 percent. The remaining percentage is covered by rock, other plant residue, and bare soil. These conditions contribute to generally poor ground cover and soil-binding characteristics, and low production for foraging animals. A few areas with virtually no vegetation have been identified, but they comprise less than 1 percent of the total area.

Soils within the proposed project area are forming in a setting with an average annual precipitation of 5 to 8 inches and an average frost-free season of 110 to 125 days. The soils are extremely variable in their potential for rehabilitation due to variations in depth, thickness of surface soil, texture, chemical properties, content of rock fragments, and slope. The dominant soils are shallow to moderately deep upland soils on sloping to strongly sloping hills, convex ridges, and plateaus. They are well drained, moderately to strongly alkaline, loamy, and clay loam soil with thin light-colored surface layers, forming in mixed material derived from sedimentary rock with varying amounts of coarse fragments on the surface. Common inclusions are deep, well-drained to somewhat poorly drained loamy soils on gently sloping floodplains, strongly sloping shallow soils on ridges and rock outcrops.

Detailed soil surveys have been made in the area (Tosco 1981; SCS and BLM 1982) to identify soil types for the purpose of determining applicable reclamation procedures, evaluating reclamation success, and conducting an impact analysis.

T-3.A.5 WILDLIFE

Habitat Types

The primary wildlife habitat type found on the project area and the various rights-of-way is the mixed-desert shrub type. There is a small amount of riparian habitat within the project area. (See Section R-3.A.4, Vegetation and Soils, for description of plant communities and species composition in this type.) Riparian habitats in arid and semi-arid localities are unique and very important reservoirs for plant and animal diversity. In the Mountain West, approximately one-half of all bird species and nearly one-third of all mammal species are supported by this habitat type (Thomas et al. 1978). There are about 13,551 acres of mixed-desert shrub and 2,901 acres of riparian habitat found on the project area.

The aquatic habitat involved with this project is found along a small portion of the White River that occurs on site and a small area at the diversion on the White River or on the Green River depending upon which water supply alternative is chosen.

Terrestrial Wildlife

Mule deer are found over the entire project area at some time of the year, but not in high numbers. There are approximately 11,878 acres of limited value year-long deer range, 1,920 acres of high priority winter range, and about 1,850 acres of critical summer range on the project site. The critical and high priority deer ranges are located, for the most part, in the riparian zone along the White River or on the nearby mesa tops (UDWR 1981a).

Pronghorns are also found on the project area with an estimated 4,051 acres of high priority year-long range and 8,678 acres of substantial value year-long range involved with the project site (UDWR 1981a).

The only game bird found in significant numbers on the project area is the mourning dove. The chukar partridge was introduced into this general area many years ago, but the bird is now rarely found. In the near future, the Utah Division of Wildlife Resources plans to reintroduce this bird into favorable habitat in the general area. Some waterfowl habitat, used mostly for resting, is found on the White River, but little nesting habitat is available.

Raptors common to the project area include red-tailed hawks, golden eagles, prairie falcons, marsh hawks, and American kestrels. The shallow, sage-covered draws in this area furnish nesting habitat for marsh hawks, while the riparian zone along the White River furnishes many tree nesting sites for other species of raptors. The entire area, however, is hunting habitat for all species of raptorial birds. There are at least 4 active golden eagle eyries and 1 active prairie falcon nest within 1 mile of the project area (UDWR 1981a).

The species of nongame mammals, nongame birds, and reptiles and amphibians that could be found on the project area are similar to those found throughout the Uintah Basin. Refer to Section R-3.A.5, Wildlife, for a discussion of these species.

Aquatic Wildlife

Studies of the White River in Utah (Lanigan and Berry 1979) indicate that there are at least 15 species of fish found in this portion of the river. Seven of these fish are native and eight are introduced. Three federally listed fishes are found in the White River near the project site (see the Threatened or Endangered Species section which follows).

Threatened or Endangered Species

Several federally listed species were identified by the U.S. Fish and Wildlife Service as potentially occurring on the project site (Table R-3-11 and Appendix R-K). Three endangered fish species have been found in the White River--the Colorado squawfish (*Ptychocheilus lucius*), the humpback chub (*Gila cypha*), and the bonytail chub (*Gila elegans*).

T-3.A 6 AGRICULTURE

Cropland

There is no cropland located within or immediately adjacent to the project area or within any of the facility corridors of the proposed action. Cropland, including prime agricultural land, in the Ashley Valley, Roosevelt, and Fort Duchesne-Ouray areas, would be affected by land-use conversion for homesites and associated urban development to accommodate the anticipated project-related population increase due to the Tosco project. For a description of croplands that would be affected, refer to Section R-3.A.6, Agriculture.

Grazing

A total of 22 grazing allotments have been identified in the Tosco project area. They encompass 629,000 acres and are used by 26 livestock operators. The allotments have an authorized carrying capacity of 54,788 animal unit months (AUMs) used primarily by sheep during the winter grazing season from November to March. A total of 2,267 animal units (1 cow or 5 sheep for 1 month equals 1 animal unit) are authorized for periods of 1 to 5 months per year (BLM 1981b).

T-3.A.7 TRANSPORTATION NETWORKS

The transportation networks that would be affected by the Tosco project are described in Section R-3.A.7, Transportation Networks.

T-3.A.8 RECREATION

There are no developed outdoor recreation facilities or intensively used outdoor recreation uses within the Tosco project area. The types and amount of this recreation use occurring in Uintah County, which includes this project area, is provided in Section R-3.A.8, Recreation.

Undeveloped recreational opportunities within the proposed project area, known as dispersed recreation and defined as impromptu camping and day use activities (Hendee et al. 1976), are seasonal due to the low quality of recreation resource. Limited dispersed camping occurs in conjunction with other outdoor recreation activities. Camping associated with hunting occurs in the fall; however, the volume is considered light compared to other dispersed camping areas within the Uintah Basin where hunting pressures are intense (proposed High Uintas Wilderness Area, Ouray National Wildlife Refuge). Recreationists occasionally use off-road vehicles (ORV's) (primarily 4-wheel drive vehicles) in the project area to view the unique geological formations or to gain access to the White River, hunting areas, and dispersed camping areas (BLM 1973a).

Canoeing and rafting occurs on the White River primarily in late spring and early summer during runoff. Recreation values for the segment of the White River that would cross the project area include rugged canyon scenery, relative abundance of wildlife (primarily deer and waterfowl), and a feeling

of remoteness. There are no known river running use figures for the White River; however, estimates run to fewer than 20 to 70 parties per year for the White River (NPS 1982). Limited fishing, predominantly for channel catfish, is also known to occur along the affected portions of the White River. As described in Section R-3.A.8, Recreation, the White River is currently on the Nationwide Rivers Inventory, Phase I list (HCRS 1981).

One area of geologic and ORV sightseeing importance is known as the "Devil's Rock House" which contains approximately 1 acre of intricately formed pillars and spines. The Devil's Rock House (Section 12, Range 22 East, Township 95) would be located within 1 mile of the proposed transmission line (easterly), product pipeline, and eastern part of the main access road for the Sand Wash project (Tosco 1982). In 1975, a 60-acre parcel of land containing Devil's Rock House was nominated for designation as an "outstanding natural area" under the administration and management of the BLM Vernal District Office. This designation is currently pending (Smith 1981; BLM 1973a).

Hunting is the largest recreation use of the project area (BLM 1973a, 1973b), although hunting pressure tends to be generally light because of better hunting areas in the region (Ouray National Wildlife Refuge and the proposed High Uintas Wilderness Area). Deer and waterfowl hunting, with fair to good hunting success, is concentrated along the White River. Rabbit and other small game hunting also occurs in the area. Trapping or hunting for coyote and bobcat is becoming increasingly popular in the Uintah Basin (BLM 1973b).

The municipal and county recreation facilities that could be affected by the employees of this project are described in Section R-3.A.8, Recreation.

T-3.A.9 CULTURAL RESOURCES

Prehistory

The Tosco project area lies within the Uintah Basin of the Colorado Plateau. Archaeological studies in the area and site distribution patterns are discussed in Section R-3.A.10, Cultural Resources.

Portions of the Tosco project area have been surveyed for cultural resources. The plant site, utility loop, access road, water pipeline, and shale disposal area were surveyed by Brigham Young University (Forsyth 1980, 1981). Twenty-three sites and two isolates were located during the survey. A large percentage of the sites were associated with sand dunes. None of the sites were excavated to test for subsurface features or strata. Most of the sites were lithic scatters, although there were several campsites and rockshelters. One site contains petroglyphs and another a cairn.

It appears from previous studies in the Tosco project area that the highest site densities are located in the sandy areas. This is further substantiated in other studies of the region including Holmer (1979), Chandler and Nickens (1979a, 1979b), Simms (1979), and Larralde and Nickens (1980). High site densities have also been found in association with rock outcroppings and drainages (Hauck et at. 1979; Weber et al. 1977; Berry and Berry 1976).

No sites listed on the National Register of Historic Places are within the Tosco project area. However, several sites have been identified as eligible. These include a hunting site that contains rock art panels extensive enough for regional comparison. Five other sites associated with sand dunes may be eligible for listing on the National Register but require further testing. (Forsyth 1981)

History

The general history of the area is discussed in Section R-3.A.10, Cultural Resources. No historic sites were located on the Tosco project area by the Brigham Young University survey (Forsyth 1981). However, Larralde and Chandler (1981) indicate that ridges and bluffs provided good vantage points and have a high density of sheepherder campsite remnants.

T-3.A.10 VISUAL RESOURCES

The proposed project would be developed within the Colorado Plateau physiographic province. Local conditions may be summarized by describing the landform as mostly a desert plateau with low rolling hills and occasional deep drainage patterns, segmented by the White River. Vegetation consists of mixed-desert shrub with interspersed riparian zones. The area is generally uninhabited, but contains a high degree of cultural modification through the presence of oil and gas activities and numerous roads.

The project area consists of four Visual Resource Management (VRM) classes. Class II begins at a point one-half mile within the eastern limits of the Tosco project area and extends eastward along the White River toward Rangely, Colorado. The VRM Class III area extends westward along the White River to the Green River and proceeds down the Green River. A VRM Class V area is located to the north of the Tosco lease area and just northwest of the Bonanza Power Plant. The majority and remaining portions of the project area are classified as VRM Class IV (BLM 1979a; BLM 1981a). Refer to Appendix R-H, Visual Resource Management Methodologies, for an explanation of VRM classes.

The project would affect the existing visual environment in only a limited number of areas, because the area is generally unseen from highly sensitive areas, does not display traits of high scenic quality, and presently contains areas of high cultural modifications. The only exceptions would occur where project compontents would be located generally within one-half mile of the Green or White rivers. To summarize, approximately 67 acres of VRM Class II areas and 28 acres of VRM Class III areas would be affected by the proposed action. Generally all of these acreages occur within one-half mile of the Green or White rivers. Refer to Section R-4.A.11, Visual Resources, for an explanation of the methodology needed to determine areas in which the visual resources would be affected.

Existing visibility conditions are discussed in Section T-4.A.2, Air Quality.

T-3.A.11 MINERAL AND ENERGY RESOURCES

The mineral and energy resources underlying the 16,452-acre lease area are similar to those found throughout the Uintah Basin. These resources are identified in Section R-3.A.13, Mineral and Energy Resources.

T-3.A.12 EXISTING LAND USE PLANS

The land use constraints for the Tosco project are summarized in Section R-3.A.14, Existing Land Use Plans.

T-3.B <u>SHALE OIL UPGRADING ALTERNATIVE</u>

This alternative processing system would be developed on the proposed project area. Consequently, the affected environment for all resources would be similar to that of the proposed action.

T-3.C <u>WHITE RIVER SECTION 17 ALTERNATIVE WATER SUPPLY SYSTEM</u>

This alternative would involve diverting water from the White River from a different point than the proposed action. However, since the characteristics of the diversion points and the land to be traversed by the pipeline would not vary significantly, the affected environment would be similar to the proposed action for all resources.

T-3.D <u>GREEN RIVER SECTION 23 ALTERNATIVE WATER SUPPLY SYSTEM</u>

This alternative would involve diverting water from the Green River in Section 23. Characteristics of Green River water quality and flow are discussed in Section R-3.A.2, Water Resources.

This river is on the Nationwide River Inventory Phase I list (HCRS 1981) as described in Section R-3.A.8, Recreation. Only limited canoeing and rafting occurs at the proposed location of the diversion structure due to the slow flow rate and the lack of appealing scenery. However, relatively good waterfowl hunting opportunties occur in the area of the water diversion structure.

The water pipeline would affect the visual resources along one-half mile on one side of the river. A total of 3 acres of VRM Class III and 6 acres of VRM Class IV, which would be located on the Uintah and Ouray Indian Reservation, would be affected.

Because of the similarities in the areas that would be affected, the affected environment would be similar to that described for the proposed action for the following resources: socioeconomics, air qualty, vegetation, soils, wildlife, agriculture, transportation networks, wilderness, cultural resources, visual resources, mineral and energy resources, and existing land use plans.

T-3.E **WHITE RIVER DAM ALTERNATIVE WATER SUPPLY SYSTEM**

This alternative would involve obtaining water directly from the proposed White River Reservoir. The water pipeline would affect visual resouces along 3 miles of the White River and one-half mile on either side of the river where the pipeline crossing would be located. A total of 18 acres of VRM Class II and 6 acres of VRM Class III would be affected.

Because of the similarities in the areas that would be affected, the affected environment would be similar to that described for the proposed action for the following resources: socioeconomics, air quality, water resources, vegetation, soils, wildlife, agriculture, transportation networks, recreation, wilderness, cultural resources, mineral and energy resources, and existing land use plans.

T-3.F **INTERBLOCK CORRIDOR WHITE RIVER DAM ALTERNATIVE WATER SUPPLY SYSTEM**

This alternatives would involve withdrawing water directly from the proposed White River Reservoir; the water pipeline would follow Tosco's interblock corridor and BLM's proposed right-of-way corridor.

There are two primary wildlife habitat types found along this alternative route; the mixed-desert shrub and the riparian type. The proposed pipeline crosses an estimated 1 mile of riparian habitat and 17.8 miles of mixed-desert shrub habitat. The proposed pipeline crosses an estimated 15.5 miles of limited value yearlong deer range, 3 miles of high priority deer winter range and 0.25 miles of high priority yearlong deer range. In addition, 13.5 miles of high priority yearlong pronghorn range is crossed as well as 5.3 miles of substantial value yearlong pronghorn range as determined by big game range maps furnished by the Utah Division of Wildlife Resources (UDWR 1981a). All other species of wildlife and threatened and/or endangered species found along this route would be the same as those noted in the proposed action writeup.

This alternative would affect visual resources along one-half mile on either side of the river where the pipeline would cross the White River. A total of 6 acres of VRM Class III would be affected.

Because the areas that would be affected do not vary significantly, the affected environment would be similar to that described for the proposed action for the following resources: socioeconomics, air quality, water resources, vegetation, soils, agriculture, transportation networks, recreation, wilderness, cultural resources, mineral and energy resources, and existing land use plans.

T-3.G **NORTH ROUTE ALTERNATIVE POWER TRANSMISSION LINE**

This alternative would involve a slightly different route for the power transmission lines. The north and south lines of this alternative would each affect one-half mile on either side of the White River. A total of 6 acres of VRM Class II and 6 acres of VRM Class III, which would be located on the Uintah and Ouray Indian Reservation, would be affected.

Because the areas that would be affected do not vary significantly, the affected environment would be similar to that described for the proposed action for the following resources: socioeconomics, air quality, water resources, vegetation, soils, agriculture, transportation networks, recreation, wilderness, cultural resources, mineral and energy resources, and existing land use plans.

T-3.H SALT LAKE CITY ALTERNATIVE PRODUCT PIPELINE

This alternative would involve transporting the product to Salt Lake City, Utah, rather than Rangely, Colorado. The information presented is summarized from the Salt Lake City Alternative -- Tosco Shale Oil Product Pipeline Technical Report (BLM and FS 1982).

T-3.H.1 SOCIOECONOMICS

The alternative would traverse Uintah, Duchesne, Wasatch, and Summit counties which are generally rural. Salt Lake County at the western end of the alternative pipeline corridor is more urban. These counties and the Uintah and Ouray Indian Reservation are experiencing development and growth from energy, water, and/or community expansion projects. For example, Uintah County is affected by the construction of the Bonanza Power Plant; Duchesne County is affected by the construction of the Central Utah Water Project; Summit County is experiencing ski area resort expansion near Park City; and Wasatch and Salt Lake counties are undergoing substantial residential and community growth.

T-3.H.2 AIR QUALITY

The ambient air quality along most of the pipeline corridor is usually good, typical of the sparsely populated non-industrial areas of the intermountain area. However, the area which would be located on the western end of the corridor in the Salt Lake Valley is subject to frequent, noticeable air quality degradation. Salt Lake County is classed as a nonattainment area for particulates and carbon monoxide, primarily as a result of emissions from vehicle traffic during periods of air stagnation resulting from temperature inversions. The east end of the corridor in the Uintah Basin is also subject to frequent inversion periods during the winter causing a visible brown haze. Vehicle exhaust, oil pit burn-off, and pollution carried from outside the Uintah Basin are additional factors in causing noticeable air quality degradation along the eastern end of the corridor during certain periods of the year.

Areas most susceptible to air quality degradation from wind blown dust from disturbed soils are in the vicinity of Leland Bench (milepost 25) to Bridgeland (milepost 54), and the area from Kamas Valley (milespost 121) to Parley's Park (milepost 132). Also, strong canyon winds in Emigration Canyon generate occasional dusty conditions when land surface disturbance exists.

T-3.H.3 WATER RESOURCES

Based on the National Topographic Maps 1:250,000 scale series, this alternative would cross 18 intermittent streams and 34 perennial streams. A complete listing of the crossings by county and milepost are included in the technical report (BLM and FS 1982).

The alternative would cross a floodplain at each stream crossing. The floodplains would vary in width from a few feet on either side of the stream to several thousand feet. All of the aboveground permanent structures for the proposed pipeline have been generally located; only one structure would be located in a floodplain (pump station number 3 at milepost 88 in the Duchesne River Valley).

T-3.H.4 VEGETATION, SOILS, AND RECLAMATION

Vegetation

Vegetation types which would be crossed by the Salt Lake City Alternative Product Pipeline equate to vegetation types described in Section R-3.A.4, Vegetation, Soils, and Reclamation, except for the addition of the perennial and annual grass type located in the terraces and foothills near Salt Lake City. The forest type equates to the Bookcliffs woodland type, with the exception that Englemann spruce and subalpine fir trees are added to the species composition list. For specific species and climatic descriptions, refer to the technical report (BLM and FS 1982).

Timber Resources

The 97 acres of timber that would be affected by the alternative pipeline are located within the Uinta National Forest. Commercial timber operations and miscellaneous forest product sales are scheduled in this area. The Blue Bench area within the Uintah and Ouray Indian Reservation supports a manageable timber resource of pinyon and juniper trees.

Threatened and Endangered Plants

Several species have been identified through the BLM, FS, and Utah Native Plant Society records and publications as being located in the vicinity of the pipeline right-of-way or occupying habitat similar to that which would be crossed by the pipeline (BLM and FS 1982). The species include the federally listed hookless cactus (Sclerocactus glaucus), a threatened species, and the following candidate species for listing as threatened or endangered-- milk-vetch (Astragalus equisolensii) (BLM and FS 1982); tidestrom beardtongue (Penstemon tidestromii) (FWS 1980); garrett bladderpod (Lesquerella garrettii) (FWS 1980); and aster (Machaeranthesa kingii) (FWS 1980).

Soils and Reclamation

In addition to soil types discussed in Section R-3.A.4, Vegetation, Soils, and Reclamation, this pipeline would also cross soils associated with the more moist, mountain and mountain valley areas of northern and north-central Utah. The additional soils which would be traversed by this pipeline include the shallow and moderately deep soils of the high mountains on 10 to 75 percent slopes with 18 to 30 inches of annual precipitation. Landslides are common in this soil grouping. The pipeline would also traverse shallow and moderately deep soils of the Wasatch Mountains and Plateaus on slopes of 5 to 40 percent with 14 to 22 inches of annual precipitation. These soil areas are subject to potential mass movement. This alternative would affect the shallow to deep soils of the Wasatch and Uinta Mountain Valleys on slopes of 1 to 5 percent with 18 to 25 inches of annual precipitation, including areas with soils underlain by cobbly and very cobbly alluvial materials.

T-3.H.5 WILDLIFE

Several terrestrial communities composed of a more or less distinct mixture of plants and animals would occur in the vicinity of the proposed pipeline route. These communities are discussed in detail in the technical report (BLM and FS 1982).

All terrestrial wildlife communities are at least partially influenced by the vegetation type in which they occur. There are six vegetation (habitat) types found along the pipeline route (see Section R-3.A.4, Vegetation and Soils, for descriptions). Table R-3-11 lists the preferred vegetative habitats of some of the wildlife species which could be affected by the alternative product pipeline.

Mammals

Big game species that could occur in the vicinity of the alternative include mule deer, pronghorn antelope, American elk, and possibly moose. The various vegetative habitats where these species could be encountered are shown in Table R-3-11. Small game mammals, such as desert cottontail rabbits or mountain cottontail rabbits occur in virtually all habitat types which would be traversed by the pipeline.

Nongame mammals that could be expected to occur in the vicinity of the pipeline include rodents, insectivores, and bats. Population levels of these species are cyclic and numbers can vary considerably each year. The whitetail prairie dog is a small mammal that is of particular significance, because prairie dog colonies may provide habitat for the federally listed black-footed ferret.

Birds

Because of the diversity of vegetative habitats which would be found along the route, over 200 species of birds can be found in the area (Griep 1982). In addition to numerous species of small songbirds, at least 7 species of upland game birds could be found along the route (BLM and FS 1982). Sagebrush habitat occupied by sage grouse would be traversed by the alternative for an estimated 8 miles. The distribution of ring-necked pheasants along this route coincides with croplands and irrigated areas. Blue grouse could be found in the higher brushy-conifer areas along the route, while chukar partridges are usually found in the rougher sagebrush-grass type.

There is an abundance of raptor habitat and a wide variety of raptorial species to be found along the alternative. Cliffs for nesting, large, open basins for hunting and nesting are found throughout the project area. Of particular importance is the occurrence of golden eagles in the general area.

Various species of waterfowl can be found along some of the wet, marshy, or riparian areas and reservoirs along the proposed route. The most significant waterfowl area is the Ouray National Wildlife Refuge, which would be crossed by the pipeline between about milepost 18 to milepost 21 (Map T-1-2, located in Appendix R-A). Other important waterfowl areas would be found at the crossings of the Duchesne River at milepost 26, 48, and 49.

Aquatic Species

There are several unique fish species found in streams and rivers that would be crossed by the pipeline. Some of these species are federally listed and are discussed in the Threatened or Endangered Species section.

Coldwater species that could be affected by the project include rainbow, brown, brook, and cutthroat trout and mountain whitefish, while warm water species include members of the minnow and sucker families.

Threatened and Endangered Species

There are no known federally listed mammal species occurring on or along the pipeline route. However, whitetail prairie dog colonies in this area could furnish habitat for the endangered black-footed ferret. Any prairie dog colony that is crossed by the pipeline would have to be surveyed by the U.S. Fish and Wildlife Service.

Three endangered bird species could occasionally fly over or stop to rest in areas on or near the alternative route. Bald eagles winter in large numbers along the Green River and around Pelican Lake and the Ouray National Wildlife Refuge. However, no bald eagles are known to nest in this part of Utah.

The peregrine falcon is known to nest in Dinosaur National Monument and these birds could range over the alternative route, particularly in Uintah County. The whooping crane has been observed in the area in the company of migrating sandhill cranes. Whooping crane could stop to rest on or near the pipeline route.

Three endangered fish species have been found in the Green River system, the Colorado squawfish, the humpback chub, and the bonytail chub. In addition, the State of Utah notes that the razorback sucker is a declining species, and this fish has been collected from the Green River.

T-3.H.6 AGRICULTURE

Cropland

The alternative product pipeline to Salt Lake City would cross 45 miles (328 acres) of cropland with a proposed pump station located at milepost 88 (also on 3 acres of cropland). Three main cropland areas occur along the proposed right-of-way in the Duchesne River Valley, Kamas Valley, and Parley's Park areas. The croplands that would be affected are predominantly irrigated, with alfalfa hay and meadow hay being the principle crops. Small grains and corn are also grown but in lesser amounts. These crops are used for the livestock industry needs.

Grazing

Construction of this pipeline alternative would disturb a total of 579 acres of land, which produce 299 AUMs of forage. Refer to Table 19 of the technical report (BLM and FS 1982) for acreage figures by ownership.

T-3.H.7 TRANSPORTATION NETWORKS

The 160 miles of pipeline associated with this alternative would cross the following transportation networks:

- light duty paved roads (15)
- state or federal highways (34)
- interstate freeways (2)
- improved roads (17)
- railroad crossings (3)
- aboveground pipelines (2)
- power transmission lines (7)

The main highways that would be used to transport pipe to construction site would be Highways 15, 189, 40, and 88. Refer to Appendix L of the technical report for traffic volume estimates along these roads.

T-3.H.8 RECREATION

The alternative product pipeline would cross both the White and Green rivers which are identified in the Nationwide River Inventory, Phase I (HCRS 1981a) (Section R-3.4.8, Recreation). The pipeline would also cross the Duchesne River several times as shown on Map T-1-2 (located in Appendix R-A) and Table C-1 of the technical report (BLM and FS 1982). The Duchesne River is considered by the Ute Indians as an important recreation fishery resource. The Provo River is also noted for fly fishing opportunities.

The crossing of the Ouray National Wildlife Refuge (milepost 18 through milepost 21) could temporarily affect waterfowl (pheasant, duck, geese) and mule deer hunting opportunities. The refuge is also used for bird watching and habitat study. The alternative pipeline would cross the Dominquez-Escalante Trail which is being considered by Congress as a National Historic Trail (BLM and FS 1982).

Both the Uinta and Wasatch National Forests would be crossed by the alternative pipeline route. Illegal ORV use occurs along these planned utility corridors. The Forest Service Wolf Creek Campground would be within 1-mile of the pipeline.

The pipeline also passes through Emigration Canyon which offers a variety of recreational opportunities including hiking along the Mormon Pioneer National Historic Trail, sightseeing, and other day use activities (BLM and FS 1982).

T-3.H.9 CULTURAL RESOURCES

The cultural resources records were checked for any previously identified sites that might lie within one-half mile of either side of the alternative pipeline route (BLM and FS 1982). Twenty-one sites were identified within the study corridor; four of these sites are listed on the National Register of Historic Places. Six of the twenty-one sites (including the four National Register sites) are listed on the Utah State Register of Historic sites. One of the twenty-one sites is currently being nominated for listing on the Utah State and National Registers. These potential or listed State and National

Register sites are located in the Salt Lake City, Fort Douglas, and Mountain Dell Reservoir areas. The remaining 14 sites have been assigned state site numbers but are not listed on either the National or State Registers. Five monuments/markers are located along the alternative route; none of these are listed on the National Register of Historic Places or have a state number.

T-3.H.10 VISUAL RESOURCES

The Salt Lake City Alternative Product Pipeline would cross portions of three physiographic provinces. The pipeline would originate in the Colorado Plateau Province where approximately half of the pipeline would be situated, traverse the Middle Rocky Mountains Province for approximately the remaining half of the length, and terminate within a few miles of entering the Basin and Range Province near Salt Lake City (Fenneman 1931). Refer to the technical report (BLM and FS 1982) for a complete description of landform, vegetation, and cultural modifications located along the proposed right-of-way.

The right-of-way consists of 4 Visual Resource Management (VRM) classes and 3 Visual Quality Objectives (VQO). (Refer to Appendix R-H, Visual Resource Management Methodologies, for definitions of terms.) Of importance are areas of at mileposts 104, 115, and 137 through 138 (VRM Class II/VQO R); mileposts 100 through 102 (VQO PR); and mileposts 96 through 100 (VQO M).

Approximately 58 acres of VRM Class II areas would be significantly affected within the pipeline right-of-way--22 acres of VQO R, 15 acres of VQO PR, and 29 acres of VQO M areas. Refer to Section R-4.A.11, Visual Resources, for an explanation of the methodology used to determine areas in which the visual resources would be affected.

T-3.H.11 GEOLOGY AND PALEONTOLOGY

The pipeline would cross three seismic zones. The pipeline would cross known faults 11 times and a suspected fault once (Stakes, et al. 1961-1962). Of the 12 fault crossings, 10 would occur in the Wasatch Mountains and 2 are on the Wasatch fault zone near the Salt Lake Valley floor at mileposts 151 and 159, near the University of Utah, and at Interstate 15. The faults in the Wasatch Mountains are believed to have been stable for several million years but faults near the Salt Lake Valley Floor have experienced movement 1 to 3 times in the past 2,000 years. Risk of movement on these faults is estimated as one chance in the next 50 years (Olsen 1982).

The 160-mile long pipeline would cross geologic formations with high (40 miles), medium (38 miles), low (68 miles), and negligible (14 miles) probability of important fossil occurrence. (Refer to the technical report (BLM and FS 1982) for a definition of these terms.)

T-3.H.12 EXISTING LAND USE PLANS

The land use constraints for this alternative are summarized on Table R-3-1. In addition to the constraints identified on the table, the land use plan that will be developed in the near future by the Ute Tribe of the Uintah and Ouray Indian Reservation could include constraints that would affect the alternative product pipeline. Refer to Section R-3.A.14, Existing Land Use Plans, for additional details.

T-3.I <u>**ALTERNATIVE ACCESS ROADS**</u>

This alternative would involve the same origins and destinations as the three proposed action access roads; however, the routes of two of these roads (east and north) would be different. For visual resources, the west access road would affect one-half mile on either side of the Green River and the east access road would affect one-half mile on either side of the White River. A total of 6 acres of VRM Class II and 6 acres of VRM Class III, which would be located on the Uintah and Ouray Indian Reservation, would be affected.

Because the areas that would be affected do not vary significantly, the affected environment would be similar to that described for the proposed action for the following resources: socioeconomics, air quality, water resources, vegetation, soils, agriculture, transportation networks, recreation, wilderness, cultural resources, mineral and energy resources, and existing land use plans.

TABLE T-3-1

EXISTING LAND USE PLANS THAT WOULD BE AFFECTED BY THE ALTERNATIVE PRODUCT PIPELINE

Planning Entity/Plan	Type of Plan	Plan Aspect Involved
BLM (Vernal District Office)	Rainbow Management Framework Plan (Multiple Use)	Allows no adverse impacts upon "natural, cultural, or recreation" values of the White and Green rivers as potential candidates for National Wild and Scenic River designation.
		Allows no surface disturbance or improvements on or adjacent to line-of-sight within 1 mile of the White River.
U.S. Forest Service Uinta National Forest	Travel Plan	Allows no ORV use along right-of-way.
	Forest Management Plan Draft EIS	Recommends utilities be restricted to a future utility corridor. Along the current pipeline alignment, restricts construction width to not exceed 75 feet; right-of-way width to be the minimum to serve facility.
	Heber City Ranger District Multiple Use Plan	Identifies areas to be avoided, such as Wolf Creek geological area, Japanese Pilot Historic Monument, timber clearcut demonstration area.
Wasatch-Cache National Forest	Travel Plan	Allows no ORV use along the right-of-way.
	Utility Corridor Evaluation - Forest Management Plan	Recommends utilities to be restricted to a utility corridor. Requires barriers on all access roads.
U.S. Fish and Wildlife Service Ouray National Wildlife Refuge	Refuge Management Plan	Requires that environmental impacts to wildlife and wildlife habitat be minimized.
U.S. Bureau of Reclamation	Little Dell	Location of dam site.
Salt Lake County	Planning and Zoning Ordinance	Prohibits any development in Emigration Canyon on natural slopes greater than 40 percent (foothills preservation ordinance, Title 22, Chapter 35).
Salt Lake City	Planning and Zoning Ordinance	Prohibits development on natural grade slopes of greater than 40 percent (city site development ordinance, Title 47 Chapter 5, Independance Site Development Activities).
	Master Plan	Prohibits construction activity in the watershed of City Creek Canyon (Water Resource Board Policy).
University of Utah	Master Plan for Facility Expansion	Locates potential new buildings and parkings area.

NOTE: Refer to Table 14 of the technical report (BLM and FS 1982) for additional details.

T-3.J. BLOCKING-UP ALTERNATIVE

Under this alternative, Tosco would acquire and mine a block-up lease area. Because the areas that would be affected do not vary significantly, the affected environment would be similar to that of the proposed action for all resources.

T-3.K NO-ACTION ALTERNATIVE

The No-Action Alternative involves the denial for the requested BLM right-of-way. The affected environment would be the same as for the proposed action.

Environmental consequences are those impacts resulting from implementing the proposed action or the alternatives. In this chapter, impacts are discussed in a level of detail that corresponds to the severity of impact. Thus, the most significant impacts are discussed in the most detail. No Wilderness Areas or any areas under formal wilderness review, study, or appeal would be directly or indirectly affected by the proposed action or alternatives. Therefore, the wilderness resource is not discussed further.

T-4.A **PROPOSED ACTION**

T-4.A.1 SOCIOECONOMICS

Population and Employment

The Tosco project has a seven-year construction period, which would peak in 1986 with 9,675 employees. The total population increase for Duchesne and Uintah counties and the Colorado area would be 7,012 persons in 1985 and 9,531 persons in 1986. Uintah County is expected to receive the greatest population and employment increases. Population increase over baseline would be greatest in 1986 for all affected areas. Uintah County population would exceed baseline by 25.7 percent (6,807 persons) in 1986. Duchesne's population increase would be 12.7 percent (2,301 persons). For the Colorado area, as a whole, the projected population impacts would be relatively small at 1.7 percent (423 persons) in 1986.

Vernal would have the largest population increase of the communities, with a 1986 increase of 27.1 percent (2,260 persons). Roosevelt's increase would be 24.4 percent (1,369 persons) in 1986. Ballard also would have a substantial population increase relative to the baseline at 10.2 percent (83 persons) in 1986. Dinosaur would have the largest proportional increase relative to its small baseline, with a 42.3 percent (186 persons) increase.

Employment increases would center in Uintah County, which have a peak increase over baseline in 1986 of 47.3 percent (5,119 persons). Duchesne County would have small increases.

In terms of housing demand, Uintah County and the community of Vernal would have the major impacts. In 1986, Uintah County's increase over baseline would be 23.9 percent (1,884 households), while Vernals' would exceed baseline demand by 28.4 percent (907 households). The community of Roosevelt would also have a 28.4 percent (474 households) increase. Again, Dinosaur with its small baseline would have the largest proportional baseline of 41.6 percent (64 households) in 1986.

With such large housing demand increases, there would be significant housing shortages. Pressure for mobile home parks, trailer courts, and modular

housing developments would result. A increase in unauthorized settlement on public and private land would also likely result.

Personal Income

Personal income that would be produced by Tosco is estimated at $172.5 million (1980 dollars) in 1986 and $97.3 million in 1989.

Government Services and Facilities

Uintah County would have the greatest increased educational demand, requiring 44 (or 15.8 percent) additional classrooms and teachers in 1986. Duchesne County's increase would be smaller at 9.4 percent above baseline.

Uintah County would have a demand for 22 (or 20.7 percent) additional hospital beds in 1986. Duchesne County would have a demand for 9 additional hospital beds. Both Duchesne and Uintah County would have a demand for 4 additional physicians and 13 additional nurses.

Minimal personnel increases would be required for mental health services in the impact area.

Uintah County would have a demand for 5 additional policemen and 1 additional patrol car. Duchesne County would have a demand for 2 additional policemen over baseline.

In 1986, Vernal's sewer needs would increase by 27.1 percent. Unless, the planned sewer system expansion is completed on schedule, the capacity would not be able to handle this demand. Roosevelt's increased demand in 1986 would be 24.4 percent. The present system could handle the additional demands.

Vernal would have the greatest increase in water connection demands. In 1986, the demand for water connections would increase by 26.8 percent. Roosevelt would have an increase of 24.4 percent. Vernal would not be able to handle its additional demand unless the planned water system expansion is completed.

Quality of Life

The local social effects associated with the implementation of this project would be significant in Uintah County and in Roosevelt, Utah. The changes would be similar to those discussed under the regional high-level scenario (Section R-4.A.1), but these effects would be of a lesser scale and intensity.

Uintah and Ouray Indian Reservation

The Tosco project would be located adjacent to the reservation and the proposed west access road would cross 6.5 miles of the reservation. The Ute

Tribe would experience impacts as discussed in detail in Section R-4.A.1, Socioeconomics.

Of most concern would be the effects from construction, such as presence of a large temporary work force, need for supporting infrastructure, increased employment of tribal members, and increased activity in and around the reservation.

T-4.A.2 AIR QUALITY

Table T-4-1 compares maximum estimated increased total suspended particulate and sulfur dioxide concentrations with the prevention of significant deterioration (PSD) incremental limitations and shows that no violations of the PSD increments are expected. Table T-4-2 compares maximum pollutant concentrations with the NAAQS, and indicates no violations except possibly for the total suspended particulates 24-hour standard. Baseline levels are predicted to exceed the NAAQS due to traffic on unpaved roads and wind-raised soil particles. Tosco particulate emissions would add to the already high levels.

The potentials for atmospheric discoloration at Dinosaur National Monument and the Uintah and Ouray Indian Reservation were calculated. The results predicted that a faintly visible yellow-brown atmospheric discoloration resulting from Tosco emissions of nitrogen oxides would be observed at the Dinosaur Visitors Center from 4 to 23 mornings per year and 0 to 11 afternoons per year, depending on the sensitivity of the observer. A faintly visible yellow-brown discoloration would be visible an estimated 0 to 29 mornings and 0 to 23 afternoons per year at the Uintah and Ouray Indian Reservation. The discoloration could also be visible in the vicinity of the facility during some conditions, especially clear, stable mornings with light winds.

Additional visibility analyses indicated that reduction in visual range would not be significant at any potential or existing Class I areas based on the significance criteria given in Chapter R-4. For more detailed information on the visibility analyis, refer to Appendix R-G or the Air Quality Technical Report (Systems Applications Inc. 1982).

T-4.A.3 WATER RESOURCES

Surface Water

The proposed Tosco operation would be a zero discharge process; therefore, Tosco's processing facilities would not alter the quality of any surface water supply. However, erosion during construction would contribute additional sediment to streams. This would be a temporary and insignificant impact. The 9,000 ac-ft/yr that Tosco proposes to withdraw from the White River represents 1.8 percent of the average annual flow. In the Green River, it represents 0.2 percent of the average annual flow. Withdrawals of these amounts would not represent significant impacts.

TABLE T-4-1

COMPARISON OF MAXIMUM INCREASED POLLUTANT CONCENTRATIONS WITH PSD INCREMENTAL LIMITATIONS

PSD Increments/Increment Consumption	SO_2 Concentration[a] (ug/m^3) 3-Hour Average	24-Hour Average	Annual Average	TSP Concentration[b] (ug/m^3) 24-Hour Average	Annual Average
Class II Areas					
Allowable PSD Class II increment	512	91	20	37	19
Tosco increment consumption	54	13	1	less than 16	less than 1
Increment consumption incuding baseline	57	14	1	less than 17	less than 1
Tosco increment consumption at Uintah and Ouray Indian Reservation	40	8	0	less than 16	less than 16
Increment consumption at Uintah and Ouray Indian Reservation including baseline	46	9	0	less than 17	less than 1
Class I Areas					
Allowable PSD Class I increment	25	5	2	10	5
Increment consumption at Flat Tops Wilderness Area (federal Class I)					
Tosco increment consumption	0	0	0	0	0
Increment consumption including baseline	0	0	0	0	0
Increment consumption at Maroon Bells-Snowmass Wilderness Area (federal Class I)					
Tosco increment consumption	0	0	0	0	0
Increment consumption including baseline	0	0	0	0	0
Increment consumption at Dinosaur National Monument (Colorado Category I and potential federal Class II)					
Tosco increment consumption	1	0	0	0	0
Increment consumption including baseline	3	0	0	0	0

TABLE T-4-1 (Concluded)

COMPARISON OF MAXIMUM INCREASED POLLUTANT CONCENTRATIONS WITH PSD INCREMENTAL LIMITATIONS

PSD Increments/Increment Consumption	SO_2 Concentration[a] (ug/m^3) 3-Hour Average	24-Hour Average	Annual Average	TSP Concentration[b] (ug/m^3) 24-Hour Average	Annual Average
Increment consumption at Colorado National Monument (Colorado Category I and potential federal Class II)					
Tosco increment consumption	0	0	0	0	0
Increment consumption incuding baseline	0	0	0	0	0

Note: For more information on the models used in this analysis, refer to Appendix R-G.

SO_2 = sulfur dioxide; TSP = total suspended particulates; ug/m^3 = micrograms per cubic meter.

[a]Calculated using SAI Gausian Puff Model with 5-kilometer grid spacing.

[b]Class II increment calculated using EPA Complex Model with 1-kilometer grid spacing; Class I consumption calculated using the SAI Gaussian Puff Model with 5-kilometer grid spacing.

TABLE T-4-2

COMPARISON OF MAXIMUM GROUND-LEVEL POLLUTANT CONCENTRATIONS WITH THE NATIONAL AMBIENT AIR QUALITY STANDARDS (NAAQS)

Pollutant / Averaging Time	Maximum Ground-Level Concentration (ug/m^3) Baseline[a]	Tosco Impact[b]	Total[c]	NAAQS (ug/m^3)
Sulfur dioxide (SO_2)				
3-Hour	185	54	239	1,300
24-Hour	23	13	36	365
Annual	0	1	1	80
Total suspended particulate (TSP)				
24-Hour	222	less than 16	less than 236	150
Annual	55	less than 1	less than 56	60
Nitrogen dioxide (NO_2)				
Annual	1	8	9	100
Carbon monoxide (CO)				
1-Hour	200	5	205	40,000
8-Hour	200	5	205	10,000
Ozone (O_3)				
1-Hour	70	2	72	240
Hydrocarbons (HC)				
3-Hour	100	105	205[d]	160[d]

Note: For more information on the models used in this analysis, refer to Appendix R-G.

ug/m^3 = micrograms per cubic meter.

[a]CO, HC, and O_3 estimated from air quality monitoring data; SO_2 and NO_2 estimated from dispersion modeling; TSP estimated from Empirical Model.

[b]Calculated using the SAI Gaussian Puff Model with 5-kilometer grid spacing, expect TSP concentrations, which were calculated using the EPA Complex I Model with 1-kilometer grid spacing.

[c]It is conservatively assumed that baseline maximum coincides with Tosco maximum.

[d]The hydrocarbon "standard" is actually a guideline to assess attainment of the ozone standard. Because the ozone standard is not predicted to be violated, exceedence of the hydrocarbon guideline is not a limiting condition.

Floodplains

Impacts to floodplains are discussed in Section R-4.A.3, Water Resources.

Ground Water

The mine shafts may encounter a more permeable zone of the Bird's Nest aquifer and would require dewatering during construction. The effect would be temporary and probably would not extend to the boundaries of the mine property. The mine, 300 to 500 feet below the Bird's Nest, might encounter a large open fracture or fracture zone extending to the Bird's Nest aquifer. Any water entering the mine would be recharged into the Bird's Nest through a well sufficiently remote to prevent recirculation.

T-4.A.4 VEGETATION, SOILS, AND RECLAMATION

Vegetation and soils would be disturbed on 4,940 acres during construction; the lands taken out of production for the life of the project (35 years) would total 3,578 acres. Areas where temporary surface disturbance would occur and where reclamation practices would be employed total 1,362 acres, which would include the disturbed areas near plant facilities, utility rights-of-way, road shoulders and ditches, and power transmission line rights-of-way. The acreages that would be disturbed and occupied by components of the proposed project are listed in Table T-4-3.

Reclamation practices that would be used by Tosco (Appendix R-J) are expected to replace grasses and forbs within 3 to 10 years after construction (Sims 1974). Shrubs and trees would require longer periods of time to approach preconstruction heights and densities; approximately 20 years for shrubs and up to 75 years for trees. However, this impact to vegetation would be insignificant. Should conditions preclude seedling growth and establishment, noxious weed germination and growth would be favored, with certain areas remaining devoid of vegetation. These conditions could result in a significant impact.

Secondary impacts from off-road vehicular traffic (due to the anticipated project-related population increase), such as crushing and uprooting native or seeded vegetation on reclaimed areas, could be significant.

Accelerated soil loss from wind and water erosion caused by activities associated with construction of corridor facilities would occur until erosion control measures are implemented (1 year). Impacts to soils would be considered generally temporary and insignificant, because soil loss is expected to be minimized with implementation of the erosion control and revegetation procedures outlined by Tosco (Appendix R-J). Analysis of Tosco's proposed reclamation program indicates reliable and effective measures and procedures would be used. However, impacts to soils would be significant if applicable erosion control measures were not implemented due to lack of compliance with approved plans or if adverse weather conditions (mainly heavy rainstorms) would occur during construction before any erosion control

TABLE T-4-3

SUMMARY OF SURFACE AREA DISTURBED, OCCUPIED, RECLAIMED, GRAZING AND CROPLAND AFFECTED BY PROJECT COMPONENT

Project Components	Area Disturbed (Total) Miles	Area Disturbed (Total) Acres	Area Occupied (Project Life) Acres	Area Reclaimed and Revegetated[a] Acres	Potential Grazing Losses[b] AUMs[c]	Potential Grazing Losses[b] Livestock Numbers[d]	Cropland Affected Acres	Prime Agricultural Affected Acres
Proposed Action:								
Plant Site and Related Facilities[e]	NA	1,086	746	340	73	24	0	0
Spent Shale Disposal Area	NA	2,000[f]	2,000	2,000[g]	133	44	0	0
Work Roads and Conveyors	22.7	298	298	0	20	7	0	0
Access Roads	49	888	444	444[h]	59	20	0	0
Water Supply System	5.9	41	0	41	3	1	0	0
Power Supply System	43	157	0	157	10	3	0	0
Product Pipeline	42	320	0	320	21	7	0	0
Construction Camp	NA	150	150	150	10	3	0	0
TOTAL	162.6	4,940	3,638	3,452	329	109	0	0
Off-Site Urban Development	NA	NA	NA	NA	0	0	1,543	463
Alternatives:								
White River Section 17 Water Supply System	6	47	0	47	3	1	0	0
Green River Section 23 Water Supply System	13	94	0	94	6	2	0	0
White River Dam Water Supply System	19	140	0	140	9	3	0	0
North Route Power Transmission Line	46	169	0	169	11	4	0	0
Salt Lake City Product Pipeline	160	1,248	6	1,248	299	100	331	179
Pump Station	NA	6	6	0	0	0	3	0
TOTAL	160	1,254	12	1,248	299	100	334	179
Interblock Corridor White River Dam Water Supply System	18.8	140	0	140	9	3	0	0
Access Roads	46	900	450	450	60	20	0	0
Block-up[j]								
Mine and Plant	NA	489	379	110	32	11	0	0
Spent Shale Disposal/ Retention Ponds	NA	2,500	0	2,500	166	55	0	0
Access Roads	49	888	414	474	59	20	0	0
Product Pipeline	42	320	0	320	23	7	0	0
Water Pipeline	5.9	41	0	41	3	1	0	0
Power Transportation	43	157	0	157	10	3	0	0
Construction Comp	NA	150	0	150	10	3	0	0
TOTAL		4,545	793	3,752	303	100	0	0

[a]Considered temporary disturbance except for spent shale disposal area.

[b]Forage losses are considered only for long-term occupancy of grazing land. Linear construction disturbance would be revegetated; no grazing losses would occur unless right-of-way would be fenced.

[c]AUMs computed as an average of 15 acres per AUM from all land ownerships.

[d]Livestock numbers are based upon a 3-month grazing season. One unit = 1 cow or 1 horse or 5 sheep (Source, BLM grazing records, Vernal, Utah).

[e]Includes interblock roads, conveyors, electric power distribution lines.

[f]Disturbance would consist of removal of surface soil and suitable material for plant growth for use in reclamation of spent shale disposal area.

[g]Reclamation of spent shale would be conducted in stages concurrent with operations and would be protected from grazing during project life. Not considered temporary disturbance.

[h]Approximately 444 acres consisting of road borrow pits would be revegetated.

[i]Cropland converted to urban uses due to project related population increases in the Ashely Valley, Pelican Lakd and Roosevelt areas.

[j]The total long-term disturbance would be 69 acres less than the proposed action under the Blocking-Up Alternative, which would result in 4 AUMs of forage or one animal less over the long-term; or 26 AUMs or 9 animals less disturbance over the short-term.

measures could be installed. A few small, unquantifiable areas (mainly abrupt steep slopes and areas of very unfavorable soils along the facility rights-of-way) would require continuing follow-up measures.

Disturbance associated with the spent shale disposal area would occur on 2,000 acres. This disturbance would occur concurrently with project operations, and the affected acreage would be removed from production for the life of the project (35 years). Reclamation of the spent shale disposal area would be accomplished in stages concurrently with project operations. The surface of the spent shale area would be stabilized and made suitable for plant growth by various reclamation measures and procedures outlined by Tosco's reclamation program. Covering the spent shale disposal area with topsoil and soil materials suitable for plant growth would minimize the problems of making the disposal area surface suitable for revegetation. Refer to Appendix R-J and Section R-4.A.4, Vegetation, Soils and Reclamation for more detailed discussion concerning availability, placement, and maintenance of soil materials for plant growth on the spent shale disposal area. Reclamation is expected to be successful based on implementation of the applicable measures outlined by Tosco (Appendix R-J) and from the demonstrated results of current field studies (Simms and Redente 1974)

Due to the nature of the soil disturbance and preconstruction conditions, no secondary impacts to off-site soils, water quality, or other resources are expected.

T-4.A.5 WILDLIFE

Habitat

This project would result in both direct and indirect losses of wildlife habitat. Direct losses of habitat as a result of construction and operation of this project would total an estimated 4,940 acres based upon the proposed action (Table T-4-3). Of these direct habitat losses (992 acres on right-of-way and 3,948 acres on the leased area), an estimated 3,362 acres would be lost for the life of the project. Indirect losses of habitat include those acres that are not physically destroyed or modified, but are close enough to project facilities to become temporarily unusable by wildlife because of isolation, dust, noise, etc. Reliable estimates of these acres cannot be made at present levels of knowledge. The long-term loss of an estimated 3,362 acres of habitat represents less than 1 percent of the habitat available in this area.

Wildlife Population

Wildlife populations on the project area could be lost or reduced with the initiation of this project. These losses would probably increase as the project moves into full production (1989) because larger numbers of workers and others coming into the area would utilize wildlife resources. Losses could be directly caused by project construction and operation, or indirectly caused by poaching, wanton killing, collecting, and similar activities.

The permanent (long-term) loss of an estimated 380 acres of critical mule deer summer range would represent about 0.09 percent of this class of habitat in the vicinity of the project area, based upon mule deer range maps furnished by the Utah Division of Wildlife Resources (1981a).

Harassment due to construction and operation activities of this project on critical mule deer summer range along the White River could cause a population reduction because of fawn abandonment or displacement of adults and fawns into less favorable areas during the critical May 15 through October 31 period. These less favorable areas would not have essential habitat components, such as adequate water and cover, thus resulting in more stress to summering mule deer. Stressful situations on winter ranges have caused population reductions because of abortion and death (Geist 1974) and the same effects could be expected on summer ranges if they were critical to local mule deer populations.

The 1,920 acres of high priority value deer winter range located on the project site represents to about 0.01 percent of this type of winter range in the vicinity of the project site. Of the 1,920 acres on the project area, 42 acres would be temporarily disturbed and 26 acres would be permanently lost for the life of the project. Harassment of wintering deer on this class of winter range during the important November 1 through May 15 period could result in some stress, but not as detrimental as stress on critical ranges.

Impacts to deer on the limited value, yearlong ranges are not expected to be significant.

Disturbance of an estimated 294 acres (171 acres on rights-of-way and 123 acres on the base area) of high priority, yearlong pronghorn antelope range represents about 0.01 percent of this class of range in the vicinity of the project area. Harassment of pronghorns in this area could cause some stress, but significant impacts to pronghorn population levels are not anticipated. Impacts to pronghorns on an estimated 3,905 acres of substantial value, yearlong range are not expected since this range represents only about 1 percent of the range type available in the area.

Removal of topsoil and storage for later reclamation, construction of ancillary facilities, and upgrading of access roads would cause direct mortality to small burrowing rodents. These population losses on an estimated 1,315 acres of temporary disturbance (rights-of-way) and 3,335 acres of permanent disturbance (leased area) would be heavy, but the high reproductive potential of these species indicate that repopulation of reclaimed areas would be rapid. The revegetation of disturbed areas to grass complex could result in a different small mammal population, because small rodents that frequent shrub habitat might not infiltrate back into a reclaimed area planted to grass (BLM 1978c).

Mourning doves feed and nest on most of the proposed site, but their habitat is marginal at best because of the uniformly poor quality habitat throughout the area. No data exist on nesting dove populations, but it can be stated that about 3,335 acres of poor quality nesting and feeding habitat would be lost over the life of the project (35 years). This loss of habitat and its

estimated production is assumed to be less than 1 percent of the Uintah County dove population.

The newly transplanted populations of chukar partridges would be extremely vulnerable to poaching during the first few years after the transplant, thus causing population reduction or possible extermination during the time the bird population is trying to establish itself.

Some small nongame songbirds would be lost or displaced by the loss of 3,335 acres of mixed-desert shrub and pinyon-juniper habitat. Since the best data indicate that there are an average of about 21 breeding pairs of small birds per 100 acres (BLM 1978c), a theoretical population loss of 700 breeding pairs could be expected from project construction and operation. It is anticipated, however, that these losses would represent less than 1 percent of the Uintah County small bird population.

The project could adversely affect raptors by eliminating about 3,335 acres of prey habitat for the life of the project (35 years). Ground nesting raptors such as marsh hawks and ferruginous hawks would also lose nesting habitat for the same period of time. Losses of raptors are not expected to be significant however, as there appears to be ample nesting and foraging habitat throughout the areas adjacent to the project.

Harassment of the four golden eagle eyries during the critical March 15 through July 15 nesting period could result in abandonment of nests and a reduction in production for that year.

Reptiles and Amphibians

Direct losses of reptiles on 3,335 acres for the life of the project and displacement on the same number of acres would total an estimated 1 percent or less of the regional population. Reproduction of these species is high enough that repopulation would be rapid once the project is abandoned. Therefore, losses are not expected to be significant to these species.

Threatened or Endangered Species

The water diversion structure on the White River could result in direct mortality to both juvenile and adult endangered fish species residing in these rivers. Instream diversion structures could cause major adverse impacts to fish by physically drawing newly hatched fish into the pipeline or drawing juvenile and adult fish against the intake structure (impingement). Since the Colorado squawfish is known to move up the White River from the Green River, there is a high potential for losses to this endangered species in the diversion structures. While the actual size of this species' remaining population is not known, any losses should be considered significant.

Numbers of humpback and bonytail chubs are very low in the White River (Smith et al. 1979). Therefore, any losses to these species caused by diversion structures would be highly significant.

Impacts to the razorback sucker would be the same as those noted above for the three federally listed fish species. Since populations of this fish are now low enough to be of concern to Utah and Colorado, any losses caused by diversion structures would be significant.

T-4.A.6 AGRICULTURE

Cropland

Project-related population increases and their associated support facilities would cause conversion of an estimated 1,543 acres of cropland, including prime agricultural land, in the nearby Ashley Valley (Vernal), Roosevelt, and the Pelican Lake areas (Table T-4-3, Section T-4.A.4). This land use conversion would contribute to the loss of cropland in the region, as discussed in Section R-4.A.6, Agriculture.

No agricultural cropland would be affected by proposed project construction or operation activities within the lease area or facility rights-of-way.

Grazing

The proposed project would remove 4,940 acres vegetation and its productive capacity for the life of the project (35 years) where surface structures and facilities would be constructed. Temporary disturbance would result from construction of pipelines, power transmission lines, and temporary construction yards and buildings near the plant site. These areas would be revegetated to preconstruction densities and production within 3 to 5 years following construction with implementation of the Tosco reclamation plan.

Loss of forage due to all construction activities would total approximately 329 AUMs (Table T-4-3, Section T-4.A.4) or less than 1 percent of the carrying capacity of the allotments involved. However, one allotment (where the plant would be located) could lose up to 3 percent of its grazing capacity or 250 AUMs for the life of the project. A 3 percent loss would not be a significant impact to an individual ranch, since most ranch operations fluctuate 10 percent or more annually depending upon moisture, growing conditions, and market fluctuations. In this area, the allotments are not grazed every year due to the variability of moisture on these desert lands, and the livestock operators maintain a high degree of flexibility in their ranch operations to compensate for the variable forage production. However, since more than 10 AUMs would be lost on one allotment, reductions in allowable use would be made.

Traffic from construction and equipment plus off-road vehicle use is anticipated to cause a greater impact through road kills and disturbance of livestock grazing patterns than actual loss of forage (Wright 1981).

T-4.A.7 TRANSPORTATION NETWORKS

Traffic projections prepared for the Tosco project indicate that some of Tosco's traffic would use new County Roads "C" and "A" (Map R-A-1, located in Appendix R-A). The impact in 1986 would be significant on U.S. 40 between Roosevelt and Vernal. By 1986, approximately 8,211 vehicles per day would use this road. The level of service would be reduced to Level E (American Association of State Highway and Transportation Officials 1965). This means traffic flow would be unstable, with momentary stoppages. All other roads in the network could accommodate the additional traffic demand. The projected traffic volume and level of service analysis for the network is presented in the Socioeconomics Technical Report (State of Utah 1982b).

Trucking water to the site until a permanent method (pipeline) can be completed would probably generate the largest number of heavy truck trips. Over eighty truck trips per day are estimated to transport materials from the site.

T-4.A.8 RECREATION

The implementation of the proposed Tosco project would directly disturb 4,940 acres from the recreation land base over the life of the project (35 years). This loss of available land for recreation use would be caused by the construction of plant, mine, and spent shale disposal facilities. Because of the hazards associated with the project, it is unlikely that public recreation use would be allowed in the area to be developed once operations are started. The amount of recreation use that would be eliminated is undeterminable with data that is currently available. However, since dispersed recreation opportunities are limited within the proposed project area, impacts upon recreation use would be considered minor. The use presently occurring in the region is described in Section R-3.A.8, Recreation.

Tosco's proposed project would cause a population increase of 9,531 in 1986 (peak construction year), and 7,012 people in 1989 (peak operation year). This would result in a population increase of 2,260 people in Vernal and 1,369 people in Roosevelt by 1986; and 2,331 people in Vernal and 1,123 people in Roosevelt by 1989 (Section S-4.A.1, Socioeconomics). Tosco also has proposed an on-site construction camp which would have a housing capacity for 1,220 people. Based on the amount of acres removed from the recreation land base and expected population increases, the following impacts upon the recreation resource and users are predicted.

The quality of the recreation canoeing and floating experience along a 4-mile segment of the White River passing through the project area would be adversely affected. Even though the occurrence of canoeing and floating is limited (between 20 to 70 river trips per year) those that float the rugged canyons of the White River would have their sense of remoteness, solitude, and naturalness intruded. Canoeists and floaters would enter the river approximately 4 miles east of Tosco's state-leased land, and pass under the proposed power transmission lines (northern and southern lines) and the new bridge from the main access road. Approximately 13 miles of the White River

would be permanently lost from any further consideration as a National Wild and Scenic River. This would be attributed to such factors as visual intrusions of dust created by heavy equipment, the main access road bridge, and the transmission lines; unnatural blasting noise; and temporary water quality degradation due to construction of a new bridge and proposed product pipeline crossing, which would affect the natural, cultural, and recreational values that have been identified as being nationally significant (Federal Register 1980a; HCRS 1981).

Fishing competition, primarily for channel catfish, along the White River would likely increase due to the on-site construction camp and the general overall population increase attributed to the proposed Tosco project. However, this impact would be considered insignificant due to marginal fishing quality and the fact that other more attractive and successful fishing areas are found within the region (Section R-4.A.8, Recreation).

Adverse impacts to camping opportunities would be limited to a loss of a few dispersed recreation campsites within the Tosco project area; however, this impact would be insignificant due to the ample availability of federal land in the Uintah Basin providing dispersed camping opportunities.

ORV activity in the general area would increase due to the predicted population increases. This increase in ORV activity and the likelihood of a proliferation of new trails, particularly weekend use, could create some problems for local federal land managers and Ute tribal officials in controlling ORV use and restricting this use to existing vehicle routes in order to minimize impacts to soils, vegetation, cultural resources, and wildlife.

Protection of the Devil's Rock House would become more difficult due to anticipated increases in visitors to this BLM-proposed outstanding natural area. The potential for vandalism and surface disturbance at the site could increase.

The quality of the hunting experience near the Tosco project area would be expected to diminish substantially due to greater competition for a limited resource. Increased hunting competition would result in less hunting success and greater hunter contacts (refer to Section R-3.A.8, Recreation, for 1980 hunter day statistics in Uintah County). However, these impacts would not be significant due to the marginal quality of the wildlife in the project area; there are several other nearby areas such as the Ouray National Wildlife Refuge and High Uinta Mountains with much higher quality deer and waterfowl hunting experiences. Poaching and wanton killing of wildlife could increase especially with the on-site construction camp of 1,220 persons (Bradley 1976). Illegal hunting on the Uintah and Ouray Indian Reservation could also increase due to the close proximity of the construction camp to tribal lands, as well as the general population increase attributed to the proposed Tosco project.

Because both Vernal and Roosevelt, Utah, have diverse municipal recreation programs, the supply of leisure activities should be adequate to meet the needs of the increased population. However, it is unknown whether the

recreation facilities planned for the Tosco on-site construction camp would be adequate. Several studies have documented the failure of such work camps to meet the recreational needs of workers residing on site (Bradley 1976; DOE 1981).

T-4.A.9 CULTURAL RESOURCES

The Tosco project would cause land modification that could affect cultural resources as described in Section R-4.A.10, Cultural Resources.

Six sites located during the survey may be eligible for nomination to the National Register of Historic Places (Forsyth 1981). There would be significant adverse impacts to these sites unless the project can be modified to avoid them. The total impact on cultural resources cannot be absolutely determined, as only a portion of the Tosco project area has been surveyed for cultural resources in compliance with 36 CFR 800, E.O. 11593 and other historic preservation legislation. However, the remainder of the affected lands would be surveyed and evaluated for significant cultural resources prior to surface disturbance.

T-4.A.10 VISUAL RESOURCES

The visual resource of the areas that would undergo significant adverse impacts as a result of the proposed action (including the duration and total number of acres that would be affected) are summarized in Table T-4-4. The placement of the project in these areas would exceed the allowable levels of contrast for each VRM class established for specific portions of the project area. Areas where impacts would exceed the acceptable levels of contrast for a specified VRM class are placed in VRM Class V (indicating rehabilitation would be necessary). Refer to Section R-4.A.11, Visual Resources, for a description of the criteria used to determine significance of visual resource impacts which would occur if the project were constructed.

T-4.A.11 MINERAL AND ENERGY RESOURCES

The accompanying table is a summary of energies required by all major phases of the Tosco project. The methodology used to determine these figures is discussed in Section R-4.A.13, Mineral and Energy Resources, and Appendix R-L.

	Trillion Btu's/Year
Net Output	90.58
Energy in Shale	142.20
Other Fuels Used	2.20
Indirect Energy	14.60
Infrastructure	22.60
Total Input	181.60
Percent Efficiency	49.9%

TABLE T-4-4
SIGNIFICANT ADVERSE VISUAL RESOURCE IMPACTS OF THE TOSCO PROPOSAL

Component	VRM Class	Acres Significantly Affected	Location and Duration of Impacts	Explanation
Proposed Action				
Access Roads	III	12	Within one-half mile each side of Green and White rivers (long-term); within the rights-of-way.	Contrast in structure of bridge across river as seen from river.
Water Supply System	III	3	Within one-half mile of the White River (long-term); within right-of-way.	Contrast in vegetation clearing for road, product pipeline, power transmission line; structural contrast with power poles and conductor, as viewed from river.
Power Transmission Line	II III	6 6	One mile where the north line would cross the White River. One mile where the south line would cross the White River (long-term); within right-of-way.	Contrast in vegetation clearing and structures of wood "H" frame poles and conductors as viewed from the rivers and roads.
Product Pipeline	II III	64 6[a]	Contrast in vegetation clearing until rehabilitation occurs as viewed from the rivers (long-term); within right-of-way.	Approximately ten miles from Rangely westward. One mile where product pipeline would cross the White River.
Alternatives				
Green River Section 23 Water Supply System	III IV	3a 6[a]	Within one-half mile of the Green River and one mile where corridor would cross Uintah County Road "B" (long-term); within right-of-way.	Contrast in structures of power poles and conductors, as seen from the Green and White rivers and Uintah County Road "B". Vegetation clearings would create long-term contrast. Possible contrast in landform modification would be long-term.
White River Section 17 Water Supply System	III	3	Within one-half mile of the White River (long-term); within right-of-way.	Contrast in vegetation clearing for road, product pipeline, power transmission line; structural contrast with power poles and conductors, as viewed from the White River. Possible long-term contrast in landform modification.
White River Dam Water Supply System	II III	18 6	Three miles along the White River and one-half mile either side of the river where the pipeline would cross the White River (long-term); within right-of-way.	Contrast in vegetation clearing for product pipeline, power transmission line, and access road. Structural contrast with power poles and conductors as seen from White River will viewed contract with landscape.
Interblock Corridor White River Dam Water Supply System	III	6	Within one-half mile either side of the river where the pipeline crosses the White River (long-term); within the right-of-way.	Contrast in vegetation clearing for pipeline; contrast would be viewed from the White River.
North Route Power Transmission Line	II III	6 6[a]	Within one-half mile of each side of the White River on the north line andwithin one-half mile each side of the White River on the south line (long-term); within right-of-way.	Contrast in vegetation clearing from power transmission line and access road, and contrast in tower structures and conductor as viewed from White River on east leg.
Salt Lake City Product Pipeline[b]				
Alternative Access Roads	III	6 6[a]	Cross the Green and White rivers, creating impacts within one-half mile either side of each river (long-term); within the right-of-way.	Contrast in vegetation clearing for pipeline; contrast would be viewed from the White and Green rivers.

NOTE: Impacts of the Blocking-Up Alternative would be the same as for the proposed action.

[a]All acres significantly affected would be located on the Uintah and Ouray Indian Reservation.

[b]Refer to Table T-4-7 for a summary of significant impacts.

This figure is on the same order of magnitude as could be expected from coal-fired electric power generation or producing oil by pumping a well.

T-4.A.12 EXISTING LAND USE PLANS

The proposed Tosco project would conflict with BLM's Bonanza and Rainbow Management Framework Plans. As shown on Map R-A-3 (located in Appendix R-A), 9.0 miles of the power transmission line would occur outside of the right-of-way corridor designated in the plans (Map R-A-3, located in Appendix R-A). This would be in direct conflict with the plans, which state that all rights-of-way are to be located within the designated corridors. Also, the White River crossing of the proposed power transmission line and product pipeline and the water pipeline and intake structure would conflict with the "no occupancy zone" (half-mile wide or line-of-sight) along the White River that is established by the management framework plans.

Parts of the proposed action may come into conflict with the Uintah County land use plan, which is presently being developed. The project area is currently zoned for mining and grazing through a county zoning ordinance. However, the new plan may consider the proposed energy developments and not present constraints to the orderly development of the Tosco project.

The Ute Tribe is in the process of assessing the land use potential for the Uintah and Ouray Indian Reservation. A land use plan probably will be developed for the reservation in the near future. This plan will contain specific constraints for the right-of-way corridor which may conflict with the proposed west access road right-of-way. Land use contraints may also be adapted to the off-reservation tracts of land (Indian allotted lands). If conflicts develop, they would have to be resolved between Tosco and the Ute Tribe.

T-4.B **SHALE OIL UPGRADING ALTERNATIVE**

Under this alternative a substitute for the proposed action shale oil processing system would be offered. All other elements of the proposed action would remain the same. Consequently, effects to water resources, vegetation, wildlife, agriculture, transportation networks, recreation, cultural resources, and visual resources would be similar to those for the proposed action.

Concerns and impacts for the common carrier would be the same as those presented for the Salt Lake City Alternative Product Pipeline (Section T-4.A).

With this alternative, the socioeconomics impacts should not be significantly different from the proposed action. The peak construction period, however, would move from 1986 to 1987. The operating peak year is expected to remain the same (1989). In 1987, the total population increase from Tosco would be 11,241 over baseline. The same distribution as under the proposed action would be expected so that most of the population increase would concentrate for this alternative, in Uintah County. During 1989, the total population

increase from Tosco would be 8,162. Again, most of the increase would center in Uintah County. See the proposed action discussion (Section T-4.A.1) for the nature of effects in Uintah County from these increases.

Table T-4-5 compares maximum increased concentrations with the PSD increments and shows that no violations are expected. Table T-4-6 compares total ground-level concentrations with the NAAQS and indicates no violations, except possibly for total suspended particulates. Baseline total suspended particulate levels are predicted to exceed the NAAQS due to traffic on unpaved roads and wind-raised soil particles. Tosco particulate emissions would add to the already high levels. Potential atmospheric discoloration would be about the same as for the proposed action, because nitrogen oxides emissions only would be 3 percent greater than the proposed action.

The difference between the energy requirements for this alternative and the proposed action process would not be sufficiently large to significantly affect the overall project energy efficiency.

T-4.C WHITE RIVER SECTION 17 ALTERNATIVE WATER SUPPLY SYSTEM

Under this alternative, water would be withdrawn from the White River at a different location (Section 17) than the proposed action and transported to the plant site via a 6-mile pipeline. Two of these miles would cross the Uintah and Ouray Indian Reservation. About 77 acres would be disturbed by construction of this water supply system. Because the land that would be affected does not vary significantly from the land that would be affected by the proposed action, impacts from this alternative would be similar to those of the proposed action for all resources. However, this alternative would conflict with BLM's Book Cliffs Management Framework Plan (described in Section R-3.A.14, Existing Land Use Plans), because 2 miles of the pipeline would be located outside the proposed right-of-way corridor. Section T-4.A.13 discusses possible constraints associated with crossing the Uintah and Ouray Indian Reservation.

T-4.D GREEN RIVER SECTION 23 ALTERNATIVE WATER SUPPLY SYSTEM

Under this alternative, water would be withdrawn from the Green River instead of the White River. About 94 acres would be disturbed. Effects to socioeconomics, air quality, water resources, vegetation, wildlife, agriculture, transportation, cultural resources, and mineral and energy resources would be similar to those of the proposed action. However, slightly different effects would occur to recreation resources, visual resources, and existing land use plans.

An alternative water diversion structure would be located on the Green River associated with this alternative affecting the "natural, cultural and recreation" values identified as nationally significant. However, impacts would not be considered significant because the alternative water diversion

TABLE T-4-5

SUMMARY OF PSD INCREMENT CONSUMPTION BY TOSCO UPGRADING ALTERNATIVE

PSD Increments/Increment Consumption	SO_2 Concentration[a] (ug/m^3) 3-Hour Average	24-Hour Average	Annual Average	TSP Concentration[b] (ug/m^3) 24-Hour Average	Annual Average
Class II Areas					
Allowable PSD Class II increment	512	91	20	37	19
Increment consumption at receptors of maximum impacts	88	21	2	less than 16	less than 1
Maximum increment consumption on Uintah/Ouray Indian Reservation	65	13	0	less than 16	less than 1
Class I Areas					
Allowable PSD Class I increment	25	5	2	10	5
Increment consumption at Flat Tops Wilderness Area (federal Class I)					
Tosco increment consumption	0	0	0	0	0
Increment consumption including baseline	1	1	0	1	0
Increment consumption at Maroon Bells-Snowmass Wilderness Area (rederal Class I)					
Tosco increment consumption	0	0	0	0	0
Increment consumption including baseline	0	0	0	0	0
Increment consumption at Dinosaur National Monument (Colorado Category I and potential federal Class II)					
Tosco increment consumption	2	0	0	0	0
Increment consumption including baseline	100	2	0	2	0
Increment consumption at Colorado National Monument (Colorado Category I and potential federal Class II)					
Tosco increment consumption	0	0	0	0	0
Increment consumption incuding baseline	0	0	0	1	0

Note: For more information on the models used in this analysis, refer to Appendix R-G.

TABLE T-4-6

SUMMARY OF MAXIMUM AMBIENT AIR QUALITY IMPACTS OF TOSCO UPGRADING ALTERNATIVE

Pollutant / Averaging Time	Maximum Ground-Level Concentration (ug/m^3) Baseline	Tosco Impact	Total	NAAQS[a] (ug/m^3)
Sulfur dioxide (SO_2)				
3-Hour	0	88	88	1,300
24-Hour	0	21	21	365
Annual	0	2	2	80
Total suspended particulate (TSP)				
24-Hour	60	less than 16	127[b]	150
Annual	20	less than 1	29[b]	60
Nitrogen dioxide (NO_2)				
Annual	1	8	9	100
Carbon monoxide (CO)				
1-Hour	200	19	219	40,000
8-Hour	200	19	219	10,000
Ozone (O_3)				
1-Hour	70	2	72	240
Hydrocarbons (HC)				
3-Hour	100	80	180	160

Note: For more information on the models used in this analysis, refer to Appendix R-G.

[a]National Ambient Air Quality Standards.

[b]On-site impact; off-site impacts are much lower, within increments.

structure would cause minimal visual intrusion upon recreation values due to its single point source impact. Natural, cultural, and recreation values at the location of the alternative water diversion would be marginal.

The quality of waterfowl and mule deer hunting along the Green River would not be expected to be permanently affected. However, short-term impacts (2 to 4 weeks), due primarily to construction-related noise, may scare the waterfowl and temporarily affect waterfowl hunting experiences at the site during the fall months, should construction take place at this time. Otherwise, no impacts to hunting experiences are predicted.

Visual resources within one-half mile of the Green River and one mile where the corridor would cross Uintah County Road "B" would be affected by construction of the water pipeline system. The vegetation clearing and power line would create visual contrast. A total of 3 acres of VRM Class III and 6 acres of VRM Class IV, all within the Uintah and Ouray Reservation would be affected.

This alternative would conflict with BLM's Book Cliffs Management Framework Plan (described in Section R-3.A.14, Existing Land Use Plans), because 1 mile of pipeline would be located outside the proposed corridor. This alternative would cross 8 miles of the Uintah and Ouray Indian Reservation. Section T-4.A.13 discusses possible constraints associated with crossing the reservation.

T-4.E <u>WHITE RIVER DAM ALTERNATIVE WATER SUPPLY SYSTEM</u>

Under this alternative, water would be withdrawn directly from the proposed White River Reservoir and transported to the plant site. About 140 acres would be disturbed by this alternative. Effects would not vary significantly from the proposed action impacts for socioeconomics, air quality, water resources, vegetation, wildlife, agriculture, transportation, recreation, cultural resources, and mineral and energy resources. However, impacts to visual resources and existing land use plans would differ.

Visual resources along 3 miles of the White River and one-half mile on either side of the river where the pipeline would cross the White River would be affected. Vegetation clearing and the power line poles and conductors would result in a long-term contrast with the existing landscape. A total of 18 acres of VRM Class II and 6 acres of Class III would be significantly affected.

In addition, this alternative would conflict with BLM's Book Cliffs Management Framework Plan because 13 miles of pipeline would be located outside the proposed right-of-way corridor. Approximately 3 miles would be located within the one-half mile protective zone designated in BLM's Bonanza Management Framework Plan.

T-4.F INTERBLOCK CORRIDOR WHITE RIVER DAM ALTERNATIVE WATER SUPPLY SYSTEM

Under this alternative, water from the White River Reservoir would be transported via a route that would follow the proposed action interblock corridors. About 139 acres would be disturbed. Effects from this alternative would not differ signficantly from the proposed action impacts except for the fact that approximately 100 more acres would be affected for socioeconomics, air quality, water resources, vegetation, wildlife, agriculture, transportation, recreation, cultural resources, mineral and energy resources and existing land use plans. However, effects to visual resources would differ slightly. Six acres of VRM Class III area within one-half mile on either side of the river where the pipeline would cross the White River would be affected. The vegetation clearing would cause a long-term contrast with the existing landscape as viewed from the White River.

This alternative would conflict with BLM's Book Cliffs Management Framework Plan (described in Section R-4.A.14, Existing Land Use Plans), because 6 miles of the pipeline would be located outside the designated right-of-way corridor and approximately 3 miles would be located within one-half mile of the White River designated protective zone within BLM's Bonanza Management Framework Plan.

T-4.G NORTH ROUTE ALTERNATIVE POWER TRANSMISSION LINE

Under this alternative a slightly different route that would cross 6.5 miles of the Uintah and Ouray Indian Reservation would be used for the power transmission system. About 169 acres would be disturbed during construction of this alternative. Because the area that would be affected does not significantly vary from the area affected by the proposed action, effects would be similar to those of the proposed action for all resources. However, conflicts to existing land use plans would differ slightly.

This alternative would conflict with BLM's Management Framework Plan (described in Section R-3.A.14, Existing Land Use Plans) by traversing within one-half mile of the White River, which is a designated protective zone.

T-4.H SALT LAKE CITY ALTERNATIVE PRODUCT PIPELINE

Under this alternative, shale oil would be transported to the Salt Lake City refinery area via a 160-mile long pipeline that would generally parallel the existing Chevron pipeline (Map R-A-2, located in Appendix R-A). About 1,254 acres would be disturbed. The impact analyses presented here are summarized from the more detailed Salt Lake City Alternative--Tosco Shale Oil Product Pipeline Technical Report (BLM and FS 1982).

T-4.H.1 SOCIOECONOMICS

The pipeline would travel through Salt Lake County, Utah County, Wasatch County, Duchesne County and Uintah County. It would require a construction work force of 100 workers. Construction would last approximately 2.5 months. Very small socioeconomics impacts would result due to the small number of workers,the short duration of construction, and the nomadic movement of pipeline construction crews. These characteristics of pipeline construction minimizes family in-migration and eliminates the opportunity for support business expansion.

T-4.H.2 AIR QUALITY

Pollutants emitted during construction of the alternative pipeline would depend upon the type, amount, and extent of equipment use. Generally, the emissions resulting from pipeline construction include non-methane hydrocarbons, nitrogen oxide, carbon monoxide, sulfur oxide, total suspended particulates, and water vapor. Dispersion of these pollutants would depend upon local atmospheric stability and meteorological conditions.

Construction would cause temporary and minimal deterioration of the ambient air quality. It would also cause localized, short-term fugitive dust conditions. Almost all surface construction produces varying amounts of dust, depending upon soil moisture conditions, wind velocity, and the activity taking place. While the severity and duration of any potential impact is difficult to predict, fugitive dust would not be a significant problem due to the use of dust control meaures (water and oil sprays).

However, if proper dust suppression techniques were not implemented, some minor violations of the National Ambient Air Quality Standards for total suspended particulates could occur, especially in Salt Lake County which is in non-attainment status for total suspended particulates. Unauthorized public use of the access road and rights-of-way by off-road vehicles could aggravate surface disturbance.

Open burning of vegetation along the alternative route might be necessary to dispose of some debris resulting from clearing operations. If this were done, some short-term air pollution would occur. The applicant would be required to obtain the appropriate state and local air quality/burning permits.

Pollution from pipeline construction would add to the existing air quality problem, especially during air inversion periods in the Uintah Basin and Salt Lake Valley areas. Air quality degradation is becoming a special concern to residents of these areas.

No significant air quality impacts would occur from operation of the alternative pipeline.

T-4.H.3 WATER RESOURCES

This alternative would cross a number of streams. Construction would disturb both the bed and the banks, raising the amount of suspended sediment to unquantifiable levels which would be higher than normal.

Actual amounts of sediment and the distance they would be transported cannot by accurately predicted; however, some general conclusions can be made.

Sediment levels would differ depending upon where construction takes place. Stream crossings which would be encountered from the project site to milepost 82 along this alternative have shallow gradients and are therefore expected to have smaller particles. Those streams from milepost 82 to the end of the pipeline are steep gradient and are expected to rapidly remove construction-induced sediment. In addition, a nearby construction project on the East Fork of Smiths Fork River shows that suspended sediment concentrations were near zero mg/l upstream from instream construction and reached an average high level at seven sites of 1,861 mg/l. Sediment levels returned to normal within 7 to 10 days. A similar situation can be expected with construction with the Tosco pipeline alternative at stream crossings.

Pump Station number 3 (milepost 88) would be the only structure located in a floodplain; existing regulations require burying the pipeline below maximum scour depth. It is not expected that this structure would change the flow or depth of flood water in the portion of the Duchesne River Valley.

The pipe would be buried a minimum of 4.5 feet deep except at stream crossings where it would be buried 6 or more feet below the streambed. It is not anticipated that the pipeline would affect ground water. However, it was reported by the Salt Lake County Water Department that some residents in Emigration Canyon get their water from shallow springs. A pipeline trench across a spring area could interrupt flow from the springs.

T-4.H.4 VEGETATION, SOILS, AND RECLAMATION

Vegetation

Construction of the alternative would remove 1,542 acres of native vegetation consisting of: 116 acres of forest, 218 acres of mountain brush, 44 acres of sagebrush, 29 acres of pinyon-juniper, 395 acres of mixed-desert shrub, 37 acres of grasses; and 84 acres of riparian vegetation. Construction would be completed within 2 years. Therefore, reclamation and revegetation procedures as outlined by the applicant in Appendix R-J would be initiated during the second or third year and ground cover should be established on all but localized sites, where vegetation did not exist prior to construction. Ground cover could be established in the majority of vegetation types within a 10 year period. Complete restoration would require from 2 to 75 years, depending upon vegetation type as explained in Section R-4.A.4, Vegetation, Soils, and Reclamation. As much as 300 years could be required for complete restoration of timber sites.

The pumping station located at (milepost 68), would remove 3 acres of mixed-desert shrub vegetation for the life of the project. See Section T-4.G.6 for discussion on second pump station at milepost 88. Restoration of vegetation cover would be initated following abandonment and removal of structures and would require 20 to 40 years for complete restoration.

Secondary impacts from vehicular traffic using the cleared line for a roadway and livestock using the same area for trailing would retard or prevent revegetation resulting in continuing erosion. Measures could be taken to control use, thereby reducing the problems.

Timber Resources

Commercial or minor wood sales are authorized in the area of analysis on the Uinta National Forest. The following dollar value represents an amount of revenue that would be generated from removal of trees during clearing operations. (Forest Service policy requires the right-of-way holder to pay for value of wood product removed during construction).

The volume of spruce, fir and aspen trees is computed at 934,000 board feet with a value of $25,120.00. Minor wood products composed of 1) fuel wood totals 1,176 cords with a value of $2,970, and 2) 348 christmas trees valued at $3,690 (BLM and FS 1982).

Values of commercial timber are based on recent comparable timber sales to timber industry in the area. Affected commercial timber would be 46 percent of the Uinta National Forest annual timber cut (for one year). Affected fuelwood volumes would be 10 percent of the total volume found within the forest.

Approximately 84 acres of commercial timber and miscellaneous forest products would be disturbed by construction of the alternative pipeline route.

The Uinta National Forest Timber Management Plan would need to be revised to reflect changes in site conditions resulting from pipeline rights-of-way sales. Such changes could significantly affect the scheduled timber sale program on the Forest, i.e., unscheduled timber removal affects programs that are designed to provide a continuous timber product supply to the public over time as well as meet the silvicultural requirements of the timber stand.

Pinyon and Juniper trees within the Uintah and Ouray Indian Reservation boundary were not considered merchantable because of the small size and scattered nature of the stand. Therefore, no volumes were estimated for that area.

Threatened and Endangered Plants

Sclerocactus glaucus, the hookless cactus, is located on gravel benches near the Green River and could be adversely affected by implementation of this alternative. A survey to determine the presence of these threatened or

endangered plants would be required prior to any construction. Section 7 consultation procedures would be initiated if analysis showed that the species could be affected.

Soils and Reclamation

Construction of this alternative would disturb 1,248 acres of soils within the pipeline right-of-way and 6 acres at two pump station facilities located at milepost 44 and milepost 88. Soil loss resulting from accelerated wind and water erosion caused by construction disturbance would occur until erosion control measures are implemented and revegetation procedures initiated (1 to 10 years). Impacts to soils would generally be considered temporary because soil loss is expected to be minimized and revegetation successful with implementation of the applicable erosion control and revegetation procedures outlined by Tosco (Appendix R-J). Soil areas subject to potential mass movement (mileposts 93.9 to 109.4) where sidehill cuts and fills would cause structural soil changes resulting in slides and increased surface disturbance and soils along a few, small unquantifiable areas of abrupt steep side slopes would require continuing follow-up measures to control erosion. Where possible, pipeline alignment would avoid highly erodible slopes and potential slide areas. Intensive implementation of applicable erosion control measures would minimize the impacts to soils.

T-4.H.5 WILDLIFE

Impacts to wildlife species would include harassment, short- and long-term destruction of vegetative habitats, temporary blocking of migration routes, and increases in illegal wanton killing.

Habitat

The most evident impact to wildlife habitat from the construction of this alternative is the complete destruction (removal) of vegetation from the pipeline right-of-way and the various facility sites. Direct impact would occur on a narrow, linear impact area. Therefore the impacts, would be small, relative to any specific area.

Approximately 1,254 acres of vegetative wildlife habitats would be disturbed (923 acres of native vegetation and 331 acres of cropland). This disturbance represents less than 1 percent of the wildlife habitat available in the pipeline route area.

Mammals

The alternative would traverse about 7 miles of critical pronghorn fawning area. If construction in this area were planned during the critical May 15 through June 15 period, pregnant does could be affected and lowered production could result. The route would also cross an estimated 23 miles of critical

deer and/or elk winter range. Impacts to wintering big game animals along the pipeline would be the same as those identified for the proposed action.

In addition to problems incurred for fawning or wintering big game animals, other impacts caused by construction activities would include indirect losses of animals from poaching, wanton killing, and automobile accidents.

Impacts to small burrowing mammals would be the same as those noted for the proposed action (Section T-4.A.5, Wildlife).

Birds

A large variety of small songbirds would be affected by the removal of brush, trees, and other vegetation from the pipeline right-of-way. Construction of th alternative would affect ground nesting species by direct destruction of nests, thus reducing production.

Sage grouse are the major game bird that would be encountered along the alternative route. Thee route would traverse about 6 miles of sagebrush habitat occupied by this species. Impacts to this ground-nesting species would include direct mortality to nesting hens, harassment of strutting males on their leks, disturbance of wintering flocks, and removal of the sagebrush overstory upon which this species is virtually 100 percent dependent. All of these impacts would reduce production during pipeline construction (1 year).

Impacts to golden eagles and other raptors would be the same as those detailed for the proposed action (Section T-4.A.5, Wildlife).

Aquatic Wildlife

Impacts to streams and rivers from pipeline crossings include sedimentation, nonpoint source pollution, fuel spills, and stream habitat alteration (Anderson, et al. 1978; Rogozen, et al. 1977). It is anticipated that there would be no significant long-term impacts to resident fish populations if stream crossings were scheduled outside periods of crucial migration or spawning activities.

A complete listing of stream crossings by milepost and the attending fishery classification is shown in Tosco Salt Lake City Alternative Product Pipeline Technical Report (BLM and FS 1982).

Threatened or Endangered Species

No federally listed threatened or endangered mammal species are known to occur on or near the alternative route. Impacts to bald eagles, whooping cranes, and peregrine falcons would be the same as those noted in Section T-4.A.5, Wildlife.

Adverse impacts to three federally listed and one state fish species of concern could occur at stream crossings if the alternative were constructed on or just upstream of spawning or nursery areas during critical times of the year. Impacts such as removal of spawning areas or siltation of spawning areas would reduce the production level of these protected species. Critical endangered fish habitat areas are found at mileposts 7, 20-21, 26-27, 48, and 150.

T-4.H.6 AGRICULTURE

Cropland

Construction of the product pipeline to Salt Lake City would disturb 331 acres of cropland (Table T-4-3). Impacts to cropland would be insignificant and short term (1 to 2 years), with the exception of the pump station (milepost 88) that would remove 3 acres of cropland from production for the life of the project (35 years). Restoration of all croplands is expected to be successful with implementation of the reclamation program proposed by Tosco (Appendix R-J). Restoration of cropland through parts of the Kamas Valley area would require special attention due to the shallow and moderately deep soils that are underlain by cobbly alluvial materials.

Grazing

Forage removed from production would vary from 3 AUMs of forage per acre for the mountain areas, to 1 AUM for every 60 acres in the low precipitation areas of the Uintah Basin. The alternative would affect an average of 3.75 AUMs per mile of range land.

Losses of forage along the route or across an allotment would not cause economic hardship to individual grazing on private range, BLM land, or Indian Reservation land during the 1 to 2 years following construction that would be required for reestablishing forage species.

Losses of forage along the route or across an allotment could cause economic hardship to individual grazing on the Uinta National Forest for 1 to 5 years following construction (BLM and FS 1982).

T-4.H.7 TRANSPORTATION NETWORKS

Impacts on the existing roads could result from activities during construction of the alternative. These impacts are of three primary types:

1. Increased traffic caused from workers traveling to and from construction work sites.

2. Increased movement of heavy equipment and materials to the construction site.

3. Disruption of roads while the pipe is placed under existing roads.

Each of these impacts could cause traffic delays and some could result in accelerated deterioration of the existing roads.

Traffic delays due to pipeline construction at road crossings would likely last between 5 and 30 minutes, and in most cases, would be considered insignificant because the traffic delays would be of short duration and would not likely cause changes in traffic flow patterns.

Approximately 716 truckloads of pipe would be hauled to build the pipeline. It is assumed the pipe would be hauled from Provo, Utah, since that is the closest location for the manufacture of steel pipe. The impact of hauling the pipe is believed to be insignificant with regard to an increase in traffic. Even if all the pipe were to be hauled for the entire line on a single weekday, Monday through Thursday, there would be as much traffic on the road as would be expected on a weekend. Of course, the pipe would be hauled over a period of weeks or months instead of a single day.

T-4.H.8 RECREATION

Due to Tosco's plan to either bore or use cofferdams for crossing the White and Green rivers, visual, noise, and other sensory impacts upon recreation users at these river crossing (milepost (MP) 6.7, 20.5, respectively), would be temporary (4 to 8 weeks) and would not permanently impair the "natural, cultural, and recreation values" from future consideration for Wild and Scenic Rivers status.

Construction-related noise, dust, and visual intrusions upon hunting and nature study pursuits within the Ouray National Wildlife Refuge would temporarily affect the quality of these experiences.

Fishing experiences along the Duchesne and Provo rivers would be temporarily impaired by this alternative due to noise, water quality deterioration, and dust generated by pipeline construction-related activity.

Minor, short-term impacts (4 to 8 weeks) upon hiking experiences along the Dominquez-Escalante Trail, which is being considered as a National Historic Trail under the National Trail System program (P.L. 94-527), would be minimal from pipeline construction and its associated heavy equipment. Hikers are accustomed to noise and visual effects on hiking experiences, since the trail parallels U.S. Highway 40. Therefore, impacts of pipeline construction activities upon hiking experiences would be virtually unnoticeable.

The crossings of both the Uinta and Wasatch National Forests and the Uintah and Ouray Indian Reservation could result in a continuance of unauthorized ORV use along the utility corridors and the need for resource protection (see Sections T-4.A.4, Vegetation, Soils, and Reclamation; T-4.A.6, Agriculture; and R-4.A.5, Cultural Resources). It would be difficult to control ORV use,

since access into both the national forests and Indian reservation along the existing Chevron corridor occurs regardless of laws limiting this use.

Of greater concern would be the temporary, construction-related, visual noise, and dust impacts (4 to 8 weeks) upon the quality of camping experiences at the Wolf Creek Campground. There could be temporary delays along the main highway access into the campground since the pipeline would cross State Highway 35 four times between Tabiona and Woodland.

Construction-related visual, noise, and dust impacts along Emigration Canyon (National Register of Historic Sites) would temporarily affect (8 to 16 weeks) the quality of hiking experiences and other day use experiences such as picnicking, along portions of the Mormon Pioneer National Historic Trail. Sightseeing along the Canyon due to heavy construction equipment traveling along Utah State Highway 65, would cause traffic delays of possibly 10 to 15 minutes.

T-4.H.9 CULTURAL RESOURCES

The Salt Lake City Alternative would cause land modification that could affect cultural resources as described in Section R-4.A.10, Cultural Resources. The magnitude of impact on cultural resources cannot be absolutely determined until field surveys are performed.

Four National and six State Register properties are listed as being within or near the 1-mile wide corridor. These properties would need avoidance, protection, and/or special consideration during pipeline construction and operation activities.

Five historic site monuments (markers) and 16 other known archaeological and/or historic sites would also require avoidance, protection, or mitigation.

T-4.H.10 VISUAL RESOURCES

The visual resource of the areas identified in Table T-4-7 would undergo significant adverse impacts as a result of this alternative. The placement of the pipeline in these areas would exceed the allowable levels of contrast for each VRM class or Visual Quality Objective (VQO) established for specific portions of the right-of-way. Areas where impacts would exceed the acceptable levels of contrast for a specified VRM class are placed in VRM class V (indicating rehabilitation would be necessary). Areas where impacts would exceed levels of contrast for a specified VQO are labeled as Unacceptable Modification (also indicating rehabilitation would be necessary). Refer to Section R-4.A.11, Visual Resources, for a description of the criteria used to determine significance of visual resource impacts which would occur if the project were constructed.

Refer to Table T-4-7 for duration and total number of acres which would be adversely affected by this alternative.

TABLE T-4-7

SIGNIFICANT ADVERSE VISUAL RESOURCE IMPACTS
(Tosco Salt Lake City Alternative Project Pipeline)[a]

Pipeline Milepost	VRM Class or VQO[a]	Significantly[c] Affected Miles	Acres	Duration of[d] Impacts	Affected Landscape[e] Feature(s)	Critical Viewpoint[f]
Chevron Alignment						
96-100	M	4	29	Long-term	Landform, vegetation	Wolf Creek
100-102	PR	2	15	Long-term	Vegetation	Wolf Creek Summit
104-108	R	3	22	Long-term	Landform, vegetation	South Fork of Provo River
108-115	R	7	51	Short-term	Vegetation	Highway 35 and Woodland
137-138	II	1	7	Short-term	Vegetation	Interstate 80

Source: BLM and FS 1982.

[a]See Appendix R-H, Visual Resource Management Methodologies, for definitions of terms.

[b]Miles affected rounded off to nearest whole mile; acres affected based upon 50-foot wide construction corridor.

[c]Short-term impacts would remain as significant visible impacts 1-5 years. Long-term impacts would remain as significant visible impacts more than 5 years.

[d]The composition of the existing landscape would be modified by changing the landform and/or vegetation.

[e]A critical viewpoint is the point where the proposed change would be most visible.

T-4.H.11 GEOLOGY AND PALEONTOLOGY

The relationship of the pipeline to seismic risk is one of potential damage to the pipeline from earthquake and potential secondary impacts to on-site and off-site resources from petroleum spills. The alternative would cross 12 areas of moderate to major risk; there would be a risk of one movement in 50 years at two faults located near Salt Lake City. Within proper design, as described in the proposed action, the pipeline would not present an unacceptable risk.

The potential extent of damage to paleontological specimens and the resultant loss of scientific information cannot be quantified but would be greatest in the 66.8 miles of pipeline that would cross formations with medium to high potential for paleontological significance.

T-4.H.12 MINERAL AND ENERGY RESOURCES

Because the alternative product pipeline is substantially longer than the proposed action pipeline, it would require more energy to pump the shale oil to market. However, this additional energy that would be required is not sufficiently large to affect the overall energy efficiency of the project.

T-4.H.11 EXISTING LAND USE PLANS

This alternative would conflict with a variety of federal agency and local government land use plans. The location and nature of these conflicts are identified in Table T-4-8. In addition, the Ute Tribe of the Uintah and Ouray Indian Reservation is in the process of developing a land use program for their reservation. The plan will contain specific constraints that could affect the alternative right-of-way corridor.

T-4-I. **ALTERNATIVE ACCESS ROAD**

Under this alternative, slightly different routes for the access roads would be used. About 900 acres would be disturbed by construction of this alternative. Since the land to be affected by this alternative would not differ significantly from the land affected by the proposed action, effects to all resources from this alternative would be similar to those of the proposed action.

T-4.J **BLOCKING-UP ALTERNATIVE**

Under this alternative, the project area would be blocked-up to form a contiguous mining and lease area. The oil shale production rate would remain the same as the proposed action, but the operating life of the plant would increase to 44 years. An additional 2,500 acres would be required for more spent shale disposal area. But, there would be no need for interblock conveyance and access.

TABLE T-4-8

CONFLICTS WITH EXISTING LAND USE PLANS
Salt Lake City Alternative Product Pipeline

Impacts Location[a]	Plan or Ordinance	Conflict
MP 6.7 (White River)	Rainbow Management Framework Plan	ROW within 0.5 mile zone of line-of-sight along the river.
MP 20.4 (Green River)	Rainbow Management Framework Plan	ROW within 0.5 mile zone of line-of-sight along the river.
MP 95.4 to 108.9	Uinta National Forest Travel Plan	Unauthorized off-road vehicles would likely continue to pose a problem along the right-of-way
MP 144-149	Wasatch National Forest Travel Plan	Unauthorized off-road vehicles would likely continue to pose a problem along the right-of-way
MP 138-157	Salt Lake County Planning and Zoning Ordinance	Variance to the foothills preservation ordinance through portion of Emigration Canyon would be necessary.
MP 142	Little Dell Reservoir Proposed by Corps of Engineers	Conflicts with proposed dam site and pipeline right-of-way
MP 149-157	Salt Lake City Planning and Zoning Ordinance	Variance to the City site development ordinance (independent site development activities) through portions of Emigration Canyon, and the foothills near the University of Utah and Gravel Pit areas would be necessary.
MP 142-149	Salt Lake City Council Proposed Annexation of Emigration Canyon	Potential conflict with existing and proposed new home sites in Emigration Canyon. Avoidance of as many home sites as necessary to avoid conflict.

TABLE T-4-8 (Concluded)

CONFLICTS WITH EXISTING LAND USE PLANS
Salt Lake City Alternative Product Pipeline

Impacts Location[a]	Plan or Ordinance	Conflict
MP 151 to 152	University of Utah-Master Plan for Facility Expansion (1981)	Potential conflict with new buildings and parking area. Utilization of existing pipelines right-of-way, on an additional expansion of the right-of-way by a few feet would be necessary to minimize conflict with University proposed facility expansion.
MP 153.6	Salt Lake City, Water Resources Board, City Creek Canyon	Variance of the Water Resource Board Policy of prohibiting construction activity in the watershed of Creek Canyon would be needed.

[a]Refer to Map T-4-2, located in Appendix R-A, for milepost locations.

A total of about 4,545 acres would be disturbed by construction of this alternative. The land affected would not differ significantly from the lands affected by the proposed action. Consequently, impacts for air quality, water resources, agriculture, transportation, recreation, cultural resources, visual resources, mineral and energy resources, and land use plans would be similar to those for the proposed action. However, effects would differ slightly for socioeconomics, vegetation, grazing and wildlife.

This alternative would have roughly the same type of magnitude of socioeconomic impacts as the proposed action. In 1986 (the peak construction year under the proposed action) the total population increase due to this alternative within the area of influence would be 8,978 persons or 13.1 percent increase over baseline. Uintah County would experience the majority of the major impacts with an increase over baseline of 6,467 persons or 24.4 percent over baseline. In 1989 (the peak operating year under the proposed action), the total population increase from the Blocking-up Alternative would be 6,311 persons or 8.6 percent above baseline. In 1989, Uintah County would have the major population increase with an increase of 4,383 persons or 15.3 percent above baseline.

In terms of employment impacts, Uintah County would also experience the majority of impacts. In 1986, employment increases over baseline would be 4,822 persons and in 1989 the increases would be 2,743 persons. Percentage increases over baseline would be 44.6 and 23.8 percent, respectively for 1986 and 1989.

As population and employment impacts would be approximately the same as the proposed action impacts, so would the impacts on housing increase and services.

This alternative would disturb the same vegetation types (and wildlife habitat) as under the proposed action, except that permanent facilities would occupy 367 acres less than the proposed action, with 230 acres less temporarily disturbed from right-of-way construction. However, 500 acres more of spent shale disposal area would be required. The net result is 69 acres additional disturbance which would result from this alternative. This minor additional acreage would not significantly vary the impacts of this alternative from those of the proposed action for vegetation, soils, and wildlife.

An additional 6 AUMs would be lost from production from this alternative over those lost as a result of the proposed action. This increase would not be significant.

T-4.K NO ACTION ALTERNATIVE

Under this alternative, the requests for federal rights-of-way would be denied. Denial would preclude Tosco from developing its project. Consequently, the impacts for the proposed action would not occur. However, the purposes of the project would not be fulfilled. The loss of the potential production of 45,000 bpsd of shale oil associated with this project, possibly

would affect the national goal of 500,000 bpsd of synfuel production to offset demands for imported oil. In addition, the inability to develop an oil shale project would have an undetermined financial impact on the Tosco Corporation.

T-5.A **CUMULATIVE IMPACTS**

Cumulative impacts result when a new project is developed in an area in which other projects exist or are proposed. Although the impacts from the individual projects might be minor, the impacts from all projects in an area could be significant. The interrelated projects considered in the cumulative impact analysis for the Tosco Sand Wash Project are listed in Tables R-A-2 and R-A-3. The projects proposed by the other applicants were not considerred here, because the cumulative impacts of all the applicants' projects were discussed in Chapter R-4, Regional Environmental Consequences.

The only resources that would sustain significant cumulative impacts from the addition of the Tosco project to the Uintah Basin would be socioeconomics, air quality, wildlife, agriculture, and recreation.

T-5.A.1 SOCIOECONOMICS

Population and Employment

Adding the effects of the interrelated projects and the effects of the Tosco project, population in the Uintah Basin would be expected to increase by 14,321 in 1986 and 21,319 in 1989. All areas would experience large impacts in 1989 rather than 1986. The cumulative effects are expected to be substantial. In 1989, for instance, Uintah County's population would increase over baseline by 53.8 percent (15,445 persons). The 1986 increase would be 39.5 percent (10,482 people). Duchesne County's increase would be much less drastic, but still substantial at 22.5 percent (4,203 persons). The Colorado area would have a moderate increase of 6.7 percent.

On a community basis, Vernal would have the largest population increase of the five communities that would be significantly affected. This would be 667 persons or 52.7 percent above baseline in 1989. Roosevelt's increase would also be substantial with a 44.8 percent (880 persons) increase. Myton's and Ballard's increases would be substantial, with 17.1 percent (180 persons) and 19.3 percent (134 persons) increases, respectively. The Colorado area of influence would also have significant increases. In 1989, Rangely's population would exceed baseline by 24.4 percent (903 persons), while Dinosaur's would increase by 194.9 percent (768 persons) over baseline.

Uintah county would capture most of the employment benefits, with a 89.8 percent (10,358 persons) increase over baseline in 1989. Duchesne County would have an increase of 10.4 percent (753 persons) for the same year.

CUMULATIVE IMPACTS - SOCIOECONOMICS

Housing

Uintah and Duchesne counties would have substantial increases in housing. In 1989 respective increases over baseline would be 49.1 (4,403 households) and 25.3 percent (1,373 households). All the identified impact area communities would have substantial increases in housing demand, with Vernal receiving the majority of increased demand. In 1989, Vernal's demand would increase by 53.5 percent (1,856 households), Roosevelt's increase would be 50.5 percent (880 households). Ballard and Myton increases are projected at 24.6 percent (59 households and 20.4 percent (44 households), respectively. Rangely's increase would be 21.4 percent (227 households), while in 1989, Dinosaur's would be 185.5 percent (236 households).

Such large housing demand increases would produce severe housing shortages and would produce substantial pressure for mobile home parks, trailer courts, and modular housing developments. It would also worsen the problem of unauthorized settlement on private and public lands.

Personal Income

Personal income produced by Tosco and the interrelated projects would be $275.1 million (1980 dollars) in 1986 and $366.4 million in 1989.

Government Services and Facilities

In 1989, Uintah County would have a demand for 69 or 21.4 percent additional teachers and additional classrooms. Duchesne County would have a demand for 25 or 13.1 percent additional classrooms and teachers.

Uintah County would have a demand for 72 additional hospital beds or 62.6 percent above baseline. Duchesne County's demand would increase by 17 hospital beds (22.7 percent). Duchesne and Uintah counties would have a demand for 11 additional physicians (42.3 percent) and 33 (41.8 percent) additional nurses.

Demand for additional mental health staff would be minimal. Duchesne and Uintah counties would have a demand for 4 more social workers and 1 additional pschyiatrist.

Uintah County would have a demand for 19 additional police officers (55.9 percent). The county would also have a demand for 1 additional police car. Duchesne County would have minimal increased demands.

Vernal's demand for sewer service would increase over baseline by 52.7 percent in 1989, while Roosevelt's increased demand would be 44.8 percent over baseline. Myton would also have significant demand increases in 1989 at 17.2 percent. Roosevelt and Myton could handle the additional growth; however, Vernal would need its planned sewer expansion completed on schedule.

Vernal's water connection demand increase over baseline would be 52.7 percent in 1989, while Roosevelt's increase would be 44.7 percent. Ballard and Myton would also require additional water connections. Increases would be 19.3 percent and 21.3 percent, respectively.

Uintah and Ouray Indian Reservation

Adding interrelated projects to potential impacts from the Tosco project would increase the magnitude of impacts to the reservation. Potential impacts would be the same as those described in Section R-4.A.1, Socioeconomics. Impacts would be smaller than the cumulative effects of all projects discussed in the regional analysis.

Quality of Life

The level of population growth associated with this level of development would have significant local social effects. The Rangely, Colorado area and Duchesne and Uintah counties in Utah would experience changes similar in nature, but at a lower order of magnitude, to those described under the regional high-level scenario (Section R-4.A.1, Socioeconomics).

T-5.A.2 AIR QUALITY

Cumulative increment consumption and the PSD increments are compared in Table T-5-1 which shows that no incremental limitations would be exceeded. Cumulative maximum concentrations are compared to the NAAQS in Table T-5-2, which shows that no NAAQS exceedences would result, except possibly the 24-hour total suspended particulates standard, which was predicted to be exceeded due to primarly to high baseline levels as discussed in Section R-4.A.2, Air Quality.

T-5.A.3 WILDLIFE

The influx of new people into Uintah County due to the Tosco project and interrelated projects would cause direct and indirect impacts to wildlife. (Uintah County is the only area where cumulative impacts to wildlife as a result of implementing the Paraho project and interrelated projects are expected to be significant.) Indirect impacts to wildlife caused by an estimated influx of 10,482 new people to Uintah County in 1986 and 15,445 new people in 1989 include, but are not limited to harassment, poaching, and wanton killing, resulting in possible wildlife population reductions. It is estimated that losses from poaching and wanton killings would increase about 39.5percent by 1986 and by 53.8 percent by 1989 because of the increase in human population. Other indirect impacts include an estimated 39.5 percent increase in demand for the opportunity to hunt and fish by 1986. There would also be a 39.5 percent increase in competition for limited licenses or permits by 1986, which would reduce the chances of local sportsmen obtaining these permits at the same rate they now enjoy.

TABLE T-5-1

COMPARISON OF PSD INCREMENTS WITH CUMULATIVE INCREMENT CONSUMPTION

PSD Increments/Increment Consumption	SO_2 Concentration (ug/m^3)[a]			TSP Concentration (ug/m^3)[b]	
	3-Hour Average	24-Hour Average	Annual Average	24-Hour Average	Annual Average
Class II Areas					
PSD Class II increment	512	91	20	37	19
Cumulative increment consumption	60	15	1	less than 18	less than 1
Cumulative increment consumption at Uintah and Ouray Indian Reservation	54	11	0	less than 19	less than 1
Class I Areas					
PSD Class I increment	25	5	2	10	5
Cumulative increment consumption at Flat Tops Wilderness Aea (federal Class I)	1	0	0	0	0
Cumulative increment consumption at Maroon Bells-Snowmass Wilderness Area (federal Class I)	0	0	0	0	0
Cumulative increment consumption at Dinosaur National Monument (Colorado Category I and potential federal Class I)	7	1	0	1	0
Cumulative increment consumption at Colorado National Monument (Colorado Category I and potential federal Class I)	0	0	0	0	0

[a] Calculated using the SAI Gaussian Puff Model with a 5-kilometer grid spacing.
[b] Class II increment calculated using EPA Complex I Model with a 1-kilometer grid spacing; Class I consumption calculated using the SAI Gaussian Puff Model with a 5-kilometer grid spacing.

TABLE T-5-2

COMPARISON OF CUMULATIVE MAXIMUM GROUND-LEVEL POLLUTANT CONCENTRATIONS WITH THE NATIONAL AMBIENT AIR QUALITY STANDARDS (NAAQS)

Pollutant/Averaging Time	Maximum Cumulative Ground-Level/Concentrations (ug/m^3)[a]	NAAQS ug/m^3
Sulfur Dioxide (SO_2)		
3-Hour	242	1,300
24-Hour	37	365
	1	80
Total Suspended Particulate (TSP)		
24-Hour	237	150
Annual	56	60
Nitrogen Dioxide (NO_2)		
Annual	9	100
Carbon Monoxide (CO)		
1-Hour	205	40,000
8-Hour	205	10,000
Ozone (^{3})		
1-Hour	72	240
Hydrocarbons (HC)		
3-Hour	205[b]	160[b]

NOTE: It is conservatively assumed that baseline maximum, Tosco Maximum, and interrelated projects maximum all coincide.

[a]Includes baseline, applicants' facility, and interrelated projects.
[b]The hydrocarbon "standard" is actually a guideline to assess attainment of the ozone standard. Because the ozone standard is not predicted to be violated, exceedence of the hydrocarbon guideline is not a limiting condition.

T-5.A.4 AGRICULTURE

Cropland

Implementation of the proposed Tosco project along with the interrelated projects would cause a predicted population increase of 21,319 people by 1989. This would result in the conversion of an estimated 4,690 acres of cropland, including prime agricultural land, to homesites and other related urban development in the Ashley Valley (Vernal), Roosevelt, and Pelican Lake areas. This is approximately 5.3 percent of the total cropland in the area. This land use conversion would contribute to the loss of cropland in the region, as discussed in Section R-4.A.6, Agriculture.

T-5.A.5 RECREATION

Based on the expected cumulative construction-related population growth in the area of influence (Uintah and Duchesne counties Utah; Mesa, Moffat, and Rio Blanco counties, Colorado) of 22,138 in 1986 and a cumulative operation-related population growth of 26,942 in 1989, significant cumulative impacts would likely result to hunting, water-oriented recreation, and municipal leisure-time activities.

Not only would a loss of game animal habitat occur to the Tosco project as well as interrelated projects, but due to the population growth projections stated above, hunting success would generally diminish because of increased hunting competition. The incidences of hunter contacts and competition for hunting permits also would be expected to increase. Similar hunting-related impacts would also occur on Uintah and Ouray Indian Reservation lands. There would likely be a greater demand for permits to hunt deer and small game animals on the reservation.

The proposed White River Dam Project would have significant positive effect especially for the Tosco on-site construction work force due to the creation of a new spectrum of water-based recreation opportunities.

Without proper planning, significant deficiencies in the quality and supply of municipal leisure-time facilities in Vernal and Roosevelt Utah, would be predicted. By 1989, there would be a 52.7 percent increase over baseline in people expected to be permanently residing in Vernal; there would be a 44.8 percent increase in Roosevelt. Studies of energy boom towns have documented the frustration, boredom, and resulting social problems which come about when adequate leisure-time facilities and park areas for workers and their families are not provided. At least one additional year-round swimming pool would be needed in the Vernal area (DOE 1981). Several existing facilities (community centers, tennis courts, basketball facilities) would need to be upgraded and expanded to meet the predicted demand for quality municipal facilities.

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GLOSSARY

ACCELERATED EROSION--Erosion much more rapid than normal, natural geologic erosion, primarily as a result of the influence of the activities of man, or in some cases, of animals.

ALLUVIUM--Clay, silt, sand, gravel, or other loose stream-deposited material.

ANCILLARY FACILITIES--Structures (compressor stations, power and communcation lines, cathodic protection systems) which are necessary for the continuous operation or maintenance of the project.

ANIMAL UNIT--One cow, one horse, one burro; five sheep or goats all being over 6 months of age.

ANIMAL UNIT MONTH--The amount of forage of a cow and a calf (6 months of age and under) would consume in 1 month. This unit is used to calculate carrying capacity and serves as a basis for grazing fees.

ARTIFACT--Any object made, modified, or used by man, usually movable.

BASELINE--The existing information from which estimates, projections, etc., are based to analyze environmental impact.

BIOME--A geographical area where plants exhibit similar characteristics.

CAIRN--A mound of stones erected as a landmark or memorial.

CHISELING--The loosening of soil without inversion and with a minimum of mixing of the surface soil in order to shattter restrictive layers (below normal plow depth) that could inhibit water movement or root development (called "chiseling" when the restrictive layers are less than 16 inches deep).

CRITICAL AREA--An area of habitat that is essential to the survival of any wildlife species sometime during its life cycle.

DISPERSED RECREATION--Camping in undeveloped sites and informal daytime recreation.

EXISTING VEHICLE ROUTES--A BLM term used to describe an off-road vehicle route which is characterized with significant surface evidence of prior vehicle travel having a minimum width of 2 feet. If nature eliminates portions of these routes, it does not legally exclude vehicle use.

EXTIRPATE--To totally remove, exterminate, or destroy.

EYRIE--The nest of a bird or prey such as an eagle or hawk.

FORB--A low growing broadleaf plant.

FREEBOARD--The height above the recorded high-water mark of a structure (such as a dam) associated with the water.

FUGITIVE DUST--Airborne silt and clay particles.

GILSONITE--Also known as Uintaite, which is a black lustrous asphalt found mainly in Utah.

GRADE--Degree of a slope or a road, channel or natural ground.

HUNTER DAY--One hunter hunting for a day or part of a day.

KEROGEN--A tar like material which occurs in shale and when heated, produces oil.

MANAGEMENT FRAMEWORK PLAN--BLM land use planning document.

MITIGATION--The abatement of diminution of impact to the environment by (1) avoiding a certain action or parts of an action, (2) emloying certain construction measures to limit the degree of impact, (3) restoring an area to preconstruction conditions, (4) preserving or maintaining an area throughout the life of a project, or (5) replacing or providing substitute resources to the environment.

NATIONAL REGISTER OF HISTORIC PLACES--A list of districts, sites, buildings, structures, and objects significant in American history, architecture, archaeology, and culture.

NATIONWIDE RIVERS INVENTORY--The Nationwide Rivers Inventory was a preliminary screening process conducted by the Heritage Conservation and Recreation Service and now administered by the National Park Service to identify the best remaining free-flowing rivers in the nation that may be appropriate for protection at the federal, state, or local level.

NATURAL EROSION--Wearing away of the earth's surface by water, ice, or other natural agents under natural environmental conditions of climate, vegetation, etc., undisturbed by man (geologic erosion).

OFF-ROAD VEHICLE (ORV)--A vehicle (including four-wheel drive vehicles, trail bikes, snowmobiles, etc., but excluding helicopters, fixed-wing aircraft, and boats) capable of traveling off-road over land, water, ice, snow, sand, marshes, etc.

OIL SHALE--Shale from which oil can be recovered by distillation.

OVERSTORY--A layer of vegetation, usually shrubs or trees, that forms a secondary layer of vegetation.

PALEONTOLOGICAL SITE--The location of life forms that existed in former geologic periods.

PASSENGER DAY--A term used to measure the amount of use on a river equal to one person for any part of one day.

PETROGLYPH--Figures, symbols, or scenes pecked or etched on rock.

PRIME AGRICULTURAL LAND (also prime farmland)--Land that is best suited for producing food, forage, fiber, and oilseed crops. The inventory of prime agricultural land is maintained by the U.S. Department of Agriculture, Soil Conservation Service.

POWER PLANT--An electric utility generating station.

PYROLYSIS--A chemical change which is brought about by the action of heat.

RETORT--A closed vessel where oil shale is heated.

RIPARIAN VEGETATION--Plants situated on the banks of a stream or a body of water or wherever the water table comes into close proximity with the land surface.

RIPRAP--A foundation or erosion control device consisting of rocks thrown together without order.

ROCK FRAGMENTS--Rock or mineral fragments having a diameter of 2 millimeters or more; for example, pebbles, cobbles, stones, and boulders.

SALINE SOIL--A soil containing soluable salts in a concentration that impairs growth of plants.

SCENARIO--An outline of natural or expected course of events.

SECONDARY ZONE OF INFLUENCE--The area within 100 miles, or 2 hours driving time, that is normally utilized by residents for recreation activities.

SHALE OIL--A crude dark oil obtained from oil shale by heating.

SHARD (also spelled "sherd")--A piece of broken up pottery.

SITE--A location showing evidence of past human activities or events.

SOIL MATERIAL (For purpose of this EIS)--Unconsolidated materials including surface layers, subsoil, and substratum materials that have favorable chemical and physical properties that can be used as a surface layer for a plant growth medium.

SPECIAL MANAGEMENT AREA--Areas managed for a special purpose by a governmental entity. Examples include Uintah and Ouray Indian Reservation, Wilderness Study Area, RARE II area.

SUBSOILING--The loosening of soil to depths greater than 16 inches (see also "CHISELING").

TAR SAND--Sand impregnated with heavy petroleum which dries up to viscous or solid bitumen.

TOPSOIL--The surface tilted layer in cultivated areas or the uppermost layer of soils containing organic matter.

UINTAH BASIN--Refers to a geographic/political area that generally includes Uintah County and adjacent areas of Duchesne and Grand Counties in Utah. Roughly equivalent to the geologic (structural) basin, which technically referred to as the Uinta Basin.

UNDERSTORY--An underlying layer of low growing vegetation.

VEGETATION TYPE--Various combinations of species which have similar stature and appearance and which dominate or appear to dominate a site.

VISITOR DAY--A recreation resource measurement equal to 1 person visiting an area for 12 hours.

VISUAL RESOURCE MANAGEMENT--The planning, design, and implementation of management objectives to provide acceptable levels of visual impacts for all resource management activities.

WATER YEAR--October 1 through September 30.

WILD AND SCENIC RIVERS ACT--Provides for the designation and protection of rivers of national significance if they are free-flowing and contain one or more outstandingly remarkable scenic, recreation, geologic, fish and wildlife, historic, cultural, or other similar values.

WILDERNESS--A wilderness, in contrast with those areas where man and his own works dominate the landscape, is recognized as an area where the earth and its community of life are untrammeled by man, where man himself is a visitor who does not remain.

WILDERNESS AREA--An area formally designated by Congress as part of the National Wilderness Preservation System.

WILDERNESS STUDY AREA--A roadless area or island that has been inventoried and found to have wilderness characteristics as described in section 603 of the FLPMA of 1976 and section 2(c) of the Wilderness Act of 1964 (78 Stat. 891).

WORK FORCE--The total number of workers in a specific undertaking.

ABBREVIATIONS AND ACRONYMS

ac--acre

ac-ft/yr--acre feet per year

ACHP--Advisory Council on Historic Preservation

AUM--Animal Unit Month

BIA--Bureau of Indian Affairs, U.S. Department of the Interior

BLM--Bureau of Land Management, U.S. Department of the Interior

bpsd--barrels per stream day

bpy--barrels per year

BR--Bureau of Reclamation, U.S. Department of the Interior

Btu--British thermal unit (a measure of heat)

cfs--cubic feet per second

CEQ--Council on Environmental Quality

CO--carbon monoxide

COE--Corps of Engineers, U.S. Department of the Army

CUP--Central Utah Project

DOI--Department of the Interior

DOT--Department of Transportation

E--Enercor-Mono Power

EIS--environmental impact statement

EPA--Environmental Protection Agency

FLPMA-Federal Land Policy and Management Act

FS--Forest Service, U.S. Department of Agriculture

ft--feet

G--Geokinetics

gpm--gallons per minute

GPM--Gaussian Puff Model

$g/m^2/y$--grams per square meter per year

HCRS--Heritage Conservation and Recreation Service

hp--horsepower

Kg/hr--Kilograms per hour

km--kilometer, thousand meters

kV--kilovolts, thousand volts

kVA--kilovolt amps, thousand volt amps

M --Magic Circle

mcfd--thousand cubic feet per day

MFP--Management Framework Plan

mg--milligrams

mg/l--milligrams per liter

mi--mile

mmcfd--million cubic feet per day

MW--megawatt

NA--not applicable

NAAQS--National Ambient Air Quality Standards

NEPA--National Environmental Policy Act

NO_x--nitrogen oxides

NO_2--nitrogen dioxide

NPDES--National Pollutant Discharge Elimination System

NPS--National Park Service, U.S. Department of the Interior

ORV--off-road vehicle

P--Paraho

PAD--Petroleum Allocation District

PAH--polycyclic aromatic hydrocarbons

PCPI--per capita personal income

pH--parts hydrogenion (used to identify acidity and alkalinity)

P.L.--public law

PMOA--Programmatic Memorandum of Agreement

PSD--prevention of significant deterioration

psi--pounds per square inch (a measure of pressure)

R.--Range

RARE II--FS second roadless area review and evaluation

R.O.W.--right-of-way

RTM--Regional Transport Model

rvd--recreation visitor days

S.--Section

S--Syntana-Utah

SAI--Systems Applications, Incorporated

scf--standard cubic feet

scfm--standard cubic feet per minute

SCS--Soil Conservation Service, U.S. Department of Agriculture

SHPO--State Historic Preservation Office

SO_2--sulfur dioxide

T.--Township

T--Tosco

THC--total hydrocarbons

tpsd--tons per stream day

TSP--total suspended particulates

UBS--Uinta Basin Synfuels

UDWR--Utah Division of Wildlife Resources

ug/m^3--micrograms per cubic meter

USFWS--U.S. Fish and Wildlife Service, U.S. Department of the Interior

VMS--Visual Management System

VRM--Visual Resource Management

VQO--Visual Quality Objective

WSA--Wilderness Study Area

yr--year

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Systems Applications, Inc.

Note: The following people are responsible for the preparation of the Air Quality Technical Report.

NAME	EDUCATION	EIS RESPONSIBILITY
Douglas A. Latimer, Project Manager/ Principal Investigator/ Senior Scientist	BME, Mechanical Engineering MS, Environmental and Resources Engineering	
William R. Oliver, Principal Investigator/ Senior Scientist		
Mark A. Yocke, Principal Investigator/ Senior Scientist	BS, Engineering MS, Engineering PhD, Engineering	

MAPS

Maps identified in the EIS are contained in a separate volume labeled as such. Each complete copy of the EIS should include a map volume.

Enercor-Mono Power Company (Enercor-Mono Power) envisions the construction of a tar sand processing plant having a daily production between 15,000 and 50,000 barrels per stream day (bpsd) and an associated surface mine in the P.R. Springs area (Cedar Camp site). Construction of this facility may be scheduled to start in 1985, with full production achieved in approximately five years. Road improvement, utility connections, and site development work would occur prior to actual plant construction.

The present reserves held by Enercor-Mono Power and its partners have been conjectured to contain sufficient resource to sustain operation at this location for at least 20 years at the 50,000 bpsd level. At present, Enercor-Mono Power are in the midst of an exploration program designed to delineate the resource base, which in turn will ultimately determine the maximum capacity of the envisioned tar sand processing plant.

Copies of the Enercor-Mono Power technical report, Project Description for the Uintah Basin Regional EIS, can be obtained from Mr. Mike San Miguel, Southern California Edison Company, 2244 Walnut Grove Avenue, Rosemead, CA 91770; Telephone (213) 572-2149.

LOCATION

Enercor-Mono Power holds extensive leases in the southern portion of P.R. Springs, in Township 15, 15 1/2 and 16 South, Range 22 and 23 East. The majority of these leases are held by the production of gas from active federal oil and gas leases. It is anticipated that these federal oil and gas leases will be converted to combined hydrocarbon leases in accordance with the recently enacted federal legislation (Public Law 97-78).

MINE AND PROCESS DESCRIPTION

The mine would be a conventional strip mine using draglines, front-end loaders, and dump trucks. During the life of the project, the mine would disturb 5,290 acres.

A haul back system using dump trucks to return the damp plant sands to the mine pit would be used for all mining areas. Mine spoil would be placed in the mined out areas along with the waste sands from the plant.

Reclamation of the spoil piles would follow the mining operation in accordance with regulatory requirements.

The plant site would occupy 200 acres which would be rehabilitated after project abandonment.

The plant would utilize a modified hot water extraction technique to recover crude bitumen material from the ore. This process was developed by the University of Utah, under the direction of Dr. Alex Oblad, based on a tar sand recovery process used in Canada. Water used in the process would be recycled. After processing, the clean sand would be returned to the mine area for disposal.

The crude bitumen would be upgraded to a synthetic crude oil using a conventional delayed coking process. Coke product would be burned in boilers to supply plant heating and hot process water requirements. It is anticipated that the synthetic crude oil, gas, and coke would contain less than 0.5 percent sulfur; therefore no special sulfur removal facilities are planned.

PRODUCT TRANSPORTATION

From the Cedar Camp plant, synthetic crude oil would be piped south to the Denver and Rio Grande Railroad adjacent to Interstate 70 and shipped via tank car unit trains to customers or to existing crude oil transmission lines. Any gas produced at the plant would be used to supplement in-plant heating requirements.

WATER SUPPLY

Presently the project proponents are studying potential sources of water supply. It appears as though large quantities of water could be available from private and agency sources. It is anticipated the water would be taken from the Green, White or Colorado rivers and piped to the proposed project site.

In the maximum production case approximately 12,000 acre-feet per year would be required.

ELECTRICAL SUPPLY

A new 20-mile, 138-kV power line would be installed from the proposed Enercor Rainbow Project to the Cedar Camp site. An estimated 720 kW of power would be required to operate the plant.

EMISSIONS

The following air pollutants would be emitted:

TOTAL CONTROLLED AIR EMISSIONS

Pollutant	Emission Rate (kilograms per hour)
Sulfur Oxides	101
Nitrogen Oxides	112
Hydrocarbons	unknown
Particulate Matter	220
Carbon Monoxide	unknown

The Air Quality Technical Report (Systems Applications Inc. 1982) discusses the control technology assumptions used to determine these emission rates.

OTHER FACILITIES

In addition to the major components, a town would be built on one of several alternative sites in the vicinity of the old town of Westwater, about 35 miles south of the plant site.

CONSTRUCTION SCHEDULE AND WORK FORCE

Construction is scheduled to start in 1985 and finish as early as 1990. If the above schedule is maintained, a peak construction work force of 2,215 would occur in 1985.

OPERATION SCHEDULE AND WORK FORCE

Operation is scheduled to start in 1987 with full production anticipated in 1990. The full production work force would be approximately 1,500 people.

EMISSIONS

The following air pollutants would be emitted:

TOTAL CONTROLLED AIR EMISSIONS

Pollutant	Emission Rate (kilograms per hour)
Sulfur Oxides	101
Nitrogen Oxides	112
Hydrocarbons	unknown
Particulate Matter	220
Carbon Monoxide	unknown

The Air Quality Technical Report (Systems Applications Inc. 1983) discusses the control technology assumptions used to determine these emission rates.

OTHER FACILITIES

In addition to the major components, a town would be built on one of several alternative sites in the vicinity of the old town of Westwater, about 25 miles south of the plant site.

CONSTRUCTION SCHEDULE AND WORK FORCE

Construction is scheduled to start in 1985 and finish as early as 1990. If the above schedule is maintained, a peak construction work force of 2,215 would occur in 1985.

OPERATION SCHEDULE AND WORK FORCE

Operation is scheduled to start in 1987 with full production anticipated in 1990. The full production work force would be approximately 1,500 people.

APPENDIX R-C

GEOKINETICS LOFRECO AND AGENCY DRAW PROJECTS

Geokinetics, Inc. proposes to develop two oil shale projects in the Uintah Basin region. The Lofreco Project would be an in-situ retort facility and the Agency Draw Project would be a surface retort facility.

LOFRECO PROJECT

Geokinetics has leases on 13 non-contiguous units, two of which are located within the Geokinetics Agency Draw block. Each unit is approximately one square mile in size and is located on state lands which have near-surface beds of oil shale to which the Lofreco true in-situ retorting process is applicable. The present concept is to successively bring each unit into commercial operation producing 5,000 bpsd of shale oil. This eventually would involve the simultaneous operation of 15 to 20 retorts which measure at minimum 220 feet on a side. After the start-up of a commercial operation in the fourth quarter of 1984, ten of the non-continguous units would be in commercial production by 1994.

LOCATION

Each section would be brought into commercial status annually commencing in the fourth quarter of 1984 with Wolf Den 1 (Map R-1-2, back cover pocket).

Name	Location
Wolf Den 1	T12S R22E, Section 36
Seep Ridge	T14S R22E, Section 2
Wolf Den 2	T13S R24E, Section 2
Agency Draw 1	T12S R20 - 21E
Agency Draw 2	T13S R20 - 21E
Buck Canyon	T12S R21E, Section 36
Sunday School Canyon	T13S R22E, Section 16
Woods Canyon	T13S R22E, Section 32
McCook Ridge	T13S R23E, Section 36
Brewer Canyon	T13S R24E, Section 16
Deep 1	T11S R23E, Section 16
Deep 2	T11S R23E, Section 2
Deep 3	T11S R24E, Section 16

Enercor and Geokinetics have mineral leases for Section 36--Enercor, for tar sand and Geokinetics, for oil shale. Geokinetics would develop the oil shale resource first, because in this area the oil shale bed is above the tar sand deposit. Enercor would then develop the tar sand.

MINE AND PROCESS DESCRIPTION

In the construction of a true in-situ retort, a pattern of blast holes would be drilled from the surface through the overburden into the oil shale bed. The holes would be loaded with explosives and fired using a carefully planned blast system. The blast results in a fragmented mass of oil shale with a high permeability. The void space in the fragmented zone would come from lifting the overburden and producing a small uplift of the surface.

The fragmented zone constitutes a true in-situ retort. The bottom of the retort would be sloped to provide drainage for the oil to a sump where it would be lifted by a number of oil production wells. Air injection holes would be drilled at one side of the retort and off-gas and oil production holes drilled at the opposite side.

The oil shale would be ignited at the air injection holes and air injected to establish and maintain a burning front that occupies the full thickness of the fragmented zone. The front is moved in a horizontal direction through the fractured shale towards the off-gas wells at the far side of the retort. As the burn front moves from the air-in to the gas-out wells, it would burn the residual coke in the retorted shale as fuel. The burning front would heat the oil shale ahead of the front, producting gas and driving out the shale oil which drains to the bottom of the retort, where it would then flow along the sloping bottom to the oil production wells. The gas would be combustible and would be used for power generation. Progress of the burn front would be monitored by thermocouples set in thermocouple wells.

FEEDSTOCKS

There are no feedstocks contemplated for use at the plant site.

PRODUCTS/BY-PRODUCTS

The primary product for the proposed retorting operations would be 5,000 barrels per stream day (bpsd) of shale oil per section of land. When all 10 sections are in production in 1994 the maximum output would be 50,000 bpsd. The by-products from the operation of the proposed project would be the product gas which could be used for on-site energy production and water, part of which could be used as a viable resource (quantity of water equivalent to oil production). A pipeline to transport the shale oil to a refinery may be necessary.

UTILITIES AND OFF-SITE CORRIDORS

Each unit would use existing access roads. These existing access roads would be used to the extent possible, however Geokinetics may need to develop additional access to the sites. Utility and product pipeline corridors may be needed, but the needs have not been defined.

WATER SUPPLY

Although water is a by-product of the process there would be a minor need for potable water. It is presently planned that this water would be acquired through a well drilled on each of the commercially producing units.

ELECTRICAL SUPPLY AND DISTRIBUTION

For each commercial facility, the produced gas would be used to generate electrical power to meet all electrical needs. There would be sufficient excess power to warrant construction of 130 kV electrical power lines to each site to export surplus power to the local distribution system.

COMMUNICATION FACILITIES

It is anticipated that communication lines would be brought into each commercially operating unit; however, a private microwave system may be a viable alternative.

CONSTRUCTION PROGRAMS

Construction activities at each unit would include, site clearing, construction of access roads, water supply system, electrical power generating facility, development of rubblized retorts, and installation of necessary manifolding and product recovery equipment (oil, gas and water separation, treatment, and handling systems).

Operation would involve igniting and burning about 25 retorts per section per year. During full operation, each section of land would produce 5,000 bpsd for about 13 years.

MANPOWER REQUIREMENTS

It is estimated that 100 people would be required to construct and operate each unit. Therefore the total number of personnel required would increase by 100 each year until all 10 units are in operation. At peak operation (1994) 1,000 people would be employed on a continuous basis.

A small construction camp would be used during first year staging activities. For the most part workers would be transported from Vernal and Roosevelt by bus to the site.

CONSTRUCTION/OPERATIONS SCHEDULE

Initial construction programs would focus on the development of power lines, the upgrading of existing roads, and site preparation. Later, power

generating facilities, retorts, product recovery systems, and on-site construction camp facilities would be constructed.

Construction is scheduled to begin on the first unit during the first quarter of 1984 and would last one year, at which point operation would begin on that unit. A new unit would be constructed each subsequent year. Thus production on the first unit could begin in the fourth quarter of 1984, and one unit would be added each year until 1994 when all units would be in production.

EMISSIONS

The following air pollutants would be emitted:

TOTAL CONTROLLED AIR EMISSIONS[a]

Pollutant	Emission Rate (kilograms per hour)
Particulate Matter	113
Sulfur Oxides	1,529
Nitrogen Oxides	522
Carbon Monoxide	0
Hydrocarbons	31

[a]All ten sections operating simultaneously. Best available control technology has not been determined for in-situ operations.

The Air Quality Technical Report (Systems Applications Inc. 1982) discusses the control technology assumptions used to determine these emission rates.

LIQUID EFFLUENT

At the present time it is anticipated that each unit would produce 2,000 to 5,000 bpsd of process water, some of which would meet the water requirements for operation (i.e., dust, cooling, ammonia wash, etc.). Any excess water would be disposed of through approved wastewater disposal methods (e.g., surface cleanup methods, deep well injection, etc.).

SOLID AND HAZARDOUS WASTES

No solid waste would be produced. Spent shale would remain underground in the retort. Any hazardous wastes generated from the process would be disposed of in an approved off-site facility.

AGENCY DRAW PROJECT

Geokinetics also holds oil shale leases on 22,000 contiguous acres located in southern Uintah County, Utah. Over one billion barrels of shale oil are contained in this area.

The proposal is to mine and surface retort 22,000 tons per stream day (tpsd) of oil shale from a 13-foot thickness containing between 28 and 33 gallons of oil per ton. Room-and-pillar mining would be used and the mine would probably be developed from an adit entrance. It is further proposed that the mine would facilitate subsequent secondary recovery of the remaining resource by means of controlled blasting and in-situ retorting of the pillars and of the lower grade oil shale located below the high-grade, mined-out bed.

LOCATION

The site is located in Uintah County, in the northeastern portion of Utah (about 70 miles south of Vernal (Map R-1-2, back cover pocket). Approximately 19,200 acres of this area was leased in April 1977 to Geokinetics by the Utah Shale Lands and Minerals Company; the remainder was leased in July 1978 from the State of Utah. This area is located in T. 12 and 13 S., R. 20 and 21 E. in the Agency Draw vicinity.

MINE AND PROCESS DESCRIPTION

The following processes would be used in this project:

1) Room-and-pillar mining
2) Mined shale transportation and crushing
3) Surface retorting
4) Spent shale disposal
5) Waste gas treatment and disposal
6) Secondary recovery by horizontal in-situ retorting

The transportation and crushing of the mined oil shale would be done with conventional belt conveyors and jaw and gyratory crushers, respectively.

Retorting may be performed by the Paraho Direct Heat process.

Additional development would involve the blasting of mine support pillars and shale underlying the mined zone in preparation for modified in-situ retorting.

FEEDSTOCKS

There are presently no plans to construct or use feedstocks.

PRODUCTS/BY-PRODUCTS

The primary product from the proposed mining and surface retorting operations would be approximately 20,000 barrels per stream day (bpsd) of shale oil. This would result in the production of an estimated 133 million barrels of shale oil during a commercial operating period of approximately 20 years. In addition, secondary in-situ recovery is anticipated to produce up to 10,000 bpsd. The by-products from the operation of the proposed project would be the product gas which would be used to produce electrical energy. Water, sulfur, and ammonia also would be produced in undetermined quantities.

UTILITIES AND OFF-SITE CORRIDORS

There are existing roads between the proposed site and the towns of Vernal and Roosevelt, Utah (each approximately 70 miles from the site). About 40 miles of county roads would need upgrading for heavy traffic access from Utah State Highway 88. About 3 miles of road would be built for access to and within the project site. Utility and/or product pipeline corridors may be needed.

WATER SUPPLY

Water supply for the project could be developed from deep wells or by the purchase of water rights from Willow Creek or Green River. The water consumption for the overall facility is estimated at 1,350 ac-ft/yr.

Water would be supplied to an on-site treatment system and then stored in tanks. A booster pump would provide water at the plant site for fire protection, sanitary purposes, boiler feed water, dust control, cooling, and other uses.

ELECTRICAL SUPPLY AND DISTRIBUTION

Electric power for construction and start-up would initially be supplied by portable generators. Later electric supply would be determined when final process selection is complete.

After the facility is operational, auxiliary power would not be needed. The product gas would be used to generate electrical power. It is estimated that the gas represents more than sufficient energy to supply all the electrical power for the needs of the entire facility and that surplus power could be sold to the local distribution system.

COMMUNICATION FACILITIES

Telephone and/or radio telephone communications systems would be required. It is anticipated that communication lines would be brought into the site; however, a private microwave system may be a viable alternative.

CONSTRUCTION PROGRAMS

Initially, construction activities would focus on access roads, power supply, site preparation, water supply, and construction camp facilities; later major mining, shale handling, retorting, product recovery, and retorted shale disposal facilities would be constructed.

The facilities would disturb approximately 800 acres in the northern portion of the Agency Draw property. Access roads and other off-site corridors are undefined at this time but would increase acreage disturbed.

MANPOWER REQUIREMENTS

Personnel requirements are estimated as follows (based on six-month averages):

Year	Construction Mine	Construction Plant	Operation Mine	Operation Plant	Total
1983	50	100			150
	100	200			300
1984	150	500			650
		800	200		1,000
1985		800	200		1,000
		500	200		700
1986			200	200	400
			200	200	400
1987			200	200	400
			200	200	400
1988			200	200	400
	100*	100	200	200	600
1989	50	50	200	250	550
	50		200	250	500

*Modified In-Situ development begins.

Peak construction is expected to require 1,000 persons from 1984 to 1985. Approximately 500 persons would be required during peak operation of the facility.

CONSTRUCTION/OPERATIONS SCHEDULE

The general project schedule which is subject to change based on completion of additional environmental assessment and right-of-way grants would be as follows:

Begin construction	April 1983
Begin surface retorting operations	January 1986
Begin modified in situ operation	1988 through 1989

EMISSIONS

The following air pollutants would be emitted:

TOTAL CONTROLLED AIR EMISSIONS[a]

Pollutant	Emission Rate (kilograms per hour)
Particulate Matter	46
Sulfur Oxides	270
Nitrogen Oxides	222
Carbon Monoxide	22
Hydrocarbons	9

[a]Combined emissions from surface and in-situ retorting operations

The Air Quality Technical Report (Systems Applications Inc. 1982) discusses the control technology assumptions used to determine these emission rates.

LIQUID EFFLUENTS

Major sources of wastewater from the proposed facility would include:

- Retort operations (including power generation);
- Effluent from line drainage, mine dewatering, and dust scrubbing operation;
- Raw water treatment plant effluent;
- Sanitary and sewage treatment system effluent;
- Leachate from spent shale or raw shale piles;
- Site runoff water.

All waste water would be treated as necessary for reuse in dust control and shale disposal and other process water requirements. There would be no discharge of waste water from the site.

If retort waters produced during the in-situ process exceed the amount that can be reused and/or evaporated, the waters would be reinjected underground.

SOLID AND HAZARDOUS WASTES

Retorted shale generated by the facility would amount to 6.6 million tons per year or 5.5 million cubic yards per year of compacted material. A disposal pile would be constructed near the plant site and is expected to cover 600 acres for the life of the project. Retorted shale would be conveyed to the disposal area where the retorted shale would be formed into a stable, impervious, and erosion-resistant land mass.

A retention dam of compacted spent shale would be constructed down-gradient of the disposal pile to prevent any runoff or leachate from reaching surface waters.

Non-hazardous wastes and refuse would be collected and disposed in an on-site landfill. The wastes may include non-saleable sulfur, Stretford chemical wastes, sludges from water treatment and shale oil tank bottoms.

Any hazardous wastes generated from the process would be disposed in an approved off-site facility.

Sohio Shale Oil Company (Sohio) Asphalt Ridge Project is a proposed two-phase tar sand development involving a pilot plant and a commercial plant. The pilot tar sand processing plant would be constructed to demonstrate a solvent-assisted extraction process and to prove design information for a larger commercial plant to be constructed later.

LOCATION

The site is located on Asphalt Ridge in Uintah County, southwest of the community of Vernal, Utah (Map R-1-2, located in inside back cover pocket).

MINE

The mining plan would include three open pits: one at the north end of the property, one near the middle, and one at the south end. The distance from the northern end to the southern end is 14 miles.

The mines would provide enough tar sand to produce 20,000 barrels per stream day (bpsd) of crude tar sand oil (bitumen) for a project life of 20 years.

PILOT PLANT FACILITY

The pilot plant would be located in the northwest quarter of the southwest quarter of Section 31, Township 5 South, Range 22 East.

Ore in small lots (totalling less than 5,000 tons) would be stockpiled at the pilot plant site. These tar sands would be transported from the stockpile to a feed bin by a front-end loader. Lean ore requiring crushing would pass through a portable crusher before delivery to the feed bin.

The extraction process is a solvent-assisted counter-current process. The tar sand would be conditioned with water at 150° to 190° F and diluted to 60 to 70 percent solids. Conditioning would be followed by an addition of solvent at 150° to 190° F in an extraction column. This extraction column is a Sohio development covered by U.S. Patent Number 4,067,796 entitled "Tar Sands Recovery System." The solvent-bitumen mixture would proceed to a solvent stripping column, and the solvent would be condensed for reuse in the extraction column. The condenser would be cooled by a closed loop cooling system.

COMMERCIAL EXTRACTION PLANT

The commercial extraction facility is under study at this time. Factors which would influence the type and location of this facility would depend on

information obtained from the pilot plant testing and from a mining study. The plant would probably be located near the pilot plant with the process being very similar.

UPGRADING PLANT

Upgrading facilities for the commercial plant have not been finalized but would probably utilize upgrading processes to produce a high quality synthetic crude from 20,000 bpsd of extracted bitumen. This crude could be refined in existing nearby refineries. Processing facilities envisioned for the commercial plant include diluent recovery, coking or hydrocracking, hyrotreating, sulfur and nitrogen removal, sulfur recovery, and process water treating. Off-site facilities including a utility plant and waste water treating facility would also be required for this plant.

TAILING DISPOSAL

The present concept of tailing disposal is to provide tailing disposal areas of sufficient size to allow the open pit mining to expand to a point where future tailings can be disposed of in the mined-out pit areas.

PRODUCT TRANSPORTATION

Sohio's upgraded crude line would connect or parallel existing lines as much as possible. The upgraded crude could then go to market by either joining Chevron's 10-inch diameter line which terminates in Salt Lake City or pipelining to Rangely, Colorado, for distribution to the midwest region of the United States.

WATER SUPPLY

Water for the facilities can be pumped from the Green River. Sohio Shale Oil Company owns an approved water right application for 5 cubic feet per second of Green River flow; application No 29105 (49-219). The water line routing from Sohio's Green River pump stations to the extraction and upgrading facilities would be confined to the lands controlled by Sohio. On an annual basis, 3,620 acre-feet of water would be used.

ELECTRICAL SUPPLY

An existing power line with a 500 Kilovolt amps (KVA) substation used for previous pilot plants is already in place at the pilot plant site.

For the full scale commercial plant electricity would likely be supplied from the Utah Power and Light Ashley Valley substation approximately six miles away.

EMISSIONS

Air emission sources include the fired heaters, storage tanks, and fugitive emissions. The following pollutants would be emitted:

MAXIMUM TOTAL CONTROLLED AIR EMISSIONS
(Commercial Facility)

Pollutant	Emission Rate (kilograms per hour)
Particulate Matter	2,553
Sulfur Oxides	373
Nitrogen Oxides	327
Carbon Monoxide	29
Hydrocarbons	88

The Air Quality Technical Report (Systems Applications Inc. 1982) discusses the control technology assumptions used to determine these emissions rates.

LIQUID EFFLUENT

Wastewater would be reused or would evaporate, resulting in a zero discharge.

SOLID AND HAZARDOUS WASTES

Any solid or hazardous wastes that would be produced during the process would be disposed in an approved manner.

OTHER FACILITIES

Sanitary facilities would be designed and constructed to local and state codes. Water would treated on site to provide potable water during commercial operations. Ancillary facilities such as offices, laboratory, sample preparation facilities, shop, warehouse, and steam generator would be housed in a single building and trailers would be used as required.

CONSTRUCTION SCHEDULE AND WORK FORCE

Construction of the commercial plant would start in 1986 and finish in 1988. A peak work force of 1,525 would occur in 1987.

OPERATION SCHEDULE AND WORK FORCE

Operation of the commercial plant would start in 1988 with full production anticipated in 1989. Full production work force would be 820 people.

PUBLIC INVOLVEMENT IN THE SCOPING PROCESS

The first step in preparing an environmental impact statement (EIS) is called "scoping." The scope of an EIS is the range of actions, alternatives, and impacts to be included in the document. The purpose of scoping is to determine the significant issues related to a proposed action that should be included in the EIS. Scoping is designed to reduce some of the past inefficiencies associated with EIS preparation.

The Bureau of Land Management (BLM) sponsored public meetings in Vernal and Salt Lake City, Utah, and Rangely, Colorado designed to involve interested citizens and groups in the scoping process. An announcement about the meetings was published in the July 6, 1981 Federal Register and distributed in local newspapers. Information on the meetings was also sent to government organizations and other groups that were potentially interested in the EIS process.

The question considered at each meeting was what are the major issues associated with the development of a synfuels industry in the Uintah Basin? The object was not to seek public support or opposition, but rather to hear concerns of interested citizens.

To facilitate discussion of the issues, attendees were divided into "work groups" after a short introductory presentation by the BLM. Each group member listed issues of concern on a sheet of paper. All issues were then compiled by a group-appointed leader and discussed. Subsequently, each person listed, on a secret ballot, the three issues that he or she felt were most significant.

After all the scoping meetings had been held, BLM personnel analyzed the issues sheets and ballots from the meetings. Issues were categorized, and the number of votes for issues included within each grouping was tabulated. The issues of greatest concern were potential impacts to socioeconomics, water resources, wildlife, and air quality.

Later, the scope of the EIS was determined by the key participants involved in preparing the EIS based on the issues identified at the scoping meetings, input from the EIS steering committee (an inter-agency advisory group composed of federal, state, local, and Ute Tribe officials), and preliminary research done by the EIS preparers.

A detailed report on the EIS scoping process, EIS Scoping Report: Uintah Basin Synfuels Development, can be obtained from the Bureau of Land Management, Division of EIS Services, Third Floor East, 555 Zang Street, Denver, Colorado 80228. It includes the list of issues raised by each work group, tabulation of work group ballots, scoping meeting participants, and a discussion of the procedures used to analyze the scoping meeting data.

CONSULTATION AND COORDINATION

The agencies, groups, and individuals that will receive a copy of the DEIS for comments are as follows:

Federal Government Agencies
- Department of the Interior
  - Bureau of Indian Affairs
  - Bureau of Reclamation
  - Fish and Wildlife Service
  - Geological Survey
  - National Park Service
  - Office of Environmental Project Review
  - Office of Surface Mining
- Department of Agriculture
  - Forest Service
  - Soil Conservation Service
- Advisory Council on Historic Preservation
- Department of the Army
  - Corps of Engineers
- Department of Energy
- Department of Transportation
- Environmental Protection Agency
- Federal Energy Regulatory Commission
- Federal Highway Administration
- Minerals Management Service
- Postal Service

Environmental Groups
- American Wilderness Alliance
- Council on Utah Resources
- Defenders of the Outdoor Heritage
- Earth First
- Friends of the Earth
- Izaak Walton League
- National Audubon Society
- National Wildlife Federation
- Native Study Society
- Sierra Club
- Trout Unlimited
- Utah Native Study Society
- Utah Wilderness Association
- Womens Conservation Council of Utah

State Governments & Agencies
- Colorado
  - State Clearinghouse
- Utah
  - Department of Community and Economic Development (and various divisions)
  - Department of Health (and various divisions)
  - Department of Natural Resources and Energy (and various divisions)

Department of Social Services
Department of Transportation
Geological and Mineral Survey
Governor's Office
Library Commission
Planning Coordinators' Office
State Clearinghouse

Local Governments

Colorado

Moffat County Commission
Rio Blanco County Commission

Utah

Duchesne County Commission
Grand County Commission
Ute Indian Tribe
Uintah County Commission

This appendix includes an explanation of the interrelated projects considered in the socioeconomic cumulative impact analysis and a discussion of the Utah Process Economic and Demographic Impact Simulation Model.

INTERRELATED PROJECTS

The projects planned for development in the Uintah Basin that were not included in the socioeconomic baseline projections, but that were determined to have impacts that would interrelate with those of the applicants' proposed projects are identified in Table R-F-1. The direct employment assumptions used for these projects are identified in this table.

UTAH PROCESS ECONOMIC AND DEMOGRAPHIC MODEL

The Utah Process Economic and Demographic Impact Simulation (UPED) Model is the official model used by the Utah State Planning Coordinator's office to project population and employment growth in the state. The UPED model is a hybrid of two standard population and economic projection methodoligies: (1) the cohort survival model and (2) the economic base model. In the three-component, cohort survival population model, future population levels are projected from base year figures by adding births, subtracting deaths, and adding net in-migration or subtracting net out-migration. The values of each of the three components of population change (births, deaths, and migration) are projected as a function of the initial year values and the resultant increments are added or subtracted to generate the first projection year's values. The process is then repeated to generate the second projection year's values and so on to the last projection year. The population is disaggregated into appropriate subgroups, called cohorts, whose values are projected over time. In UPED, sex and single year of age cohorts are used. Through the projection years, of course, each cohort ages and its behavior with respect to demand for goods and services, labor force participation, fertility, mortality, and geographic mobility varies with the aging process.

According to the economic base concept, for all but the largest (national-continental regions), the primary determinant of the level of economic activity, and consequently of population size, is the amount of goods and services produced for export to other areas. Increases or decreases in basic (export) employment produce corresponding changes in the number of households deriving their income from these sectors. These changes, in turn, product changes in the demand for goods and services produced locally for the local consumption. (These local production-local consumption activities are referred to variously as non-basic, service, residentiary, or population dependent sectors.) Initial changes in population dependent sectors in turn, produce changes in population and in household incomes which generate further

TABLE R-F-1

DIRECT EMPLOYMENT ASSUMPTIONS FOR INTERRELATED PROJECTS
(Not Included In Baseline)

Project	Barrels of Oil	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
White River Shale	100,000															
Const-camp[a]		0	90	915	515	175	515	1,195	2,020	1,900	1,470	1,440	810	140	0	0
Const-noncamp[b]		0	85	915	515	170	515	1,195	2,015	1,895	1,470	1,440	810	140	0	0
Operations		0	0	10	70	370	840	885	990	1,285	1,865	2,215	2,490	3,040	3,355	3,355
C and A Tar Sand	20,000															
Const-camp		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Const-noncamp		0	45	0	125	200	225	0	0	0	0	0	0	0	0	0
Operations		0	0	0	65	145	320	320	320	320	320	320	320	320	320	320
Bananza Power Plant (Unit 2)	NA															
Const-camp		0	0	0	0	0	0	0	100	100	100	100	100	0	0	0
Const-noncamp		0	0	0	0	0	0	0	280	406	681	592	200	0	0	0
Operations		0	0	0	0	0	0	0	0	20	20	66	80	80	80	80
Deserado Mine	NA															
Const-camp		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Const-noncamp		0	0	0	0	0	0	0	5	100	38	0	0	0	0	0
Operations		0	0	0	0	0	0	0	9	94	218	240	240	240	240	240
Water Development Projects	NA															
Const-camp		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Const-noncamp		0	0	0	10	20	40	50	80	130	170	110	30	3	0	0
Operations		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
White River Dam	NA															
Const-camp		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Const-noncamp		0	94	94	36	36	0	0	0	0	0	0	0	0	0	0
Operations		0	0	0	0	5	5	5	5	5	5	5	5	5	5	5
Western Tar Sand	5,000															
Const-camp		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Const-noncamp		0	25	0	0	50	50	0	0	0	0	0	0	0	0	0
Operations		0	4	4	4	0	0	7	7	7	7	7	7	7	7	7
Ramex	NA															
Const-camp		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Const-noncamp		0	50	50	0	0	0	0	0	0	0	0	0	0	0	0
Operations		0	0	0	50	50	50	50	50	50	50	50	50	50	50	50
GRAND TOTAL	125,000															
Const-camp		0	90	915	515	175	515	1,195	2,120	2,000	1,570	1,540	910	140	0	0
Const-noncamp		0	299	1,059	686	476	830	1,245	2,380	2,531	2,359	2,142	1,040	143	0	0
Operations		0	4	14	189	570	1,215	1,267	1,381	1,781	2,485	2,903	3,192	3,742	4,057	4,057

NOTE: NA = not applicable.

[a]Refers to construction workers who would live in a construction camp.

[b]Refers to construction workers who would not live in a construction camp.

changes until, finally, a given projected initial change in basic sector employment will produce a "multipliered" change in population dependent and local employment as well as in population.

In UPED, the economic base methodology is adapted to affect population projection through the migration component. Population projections, in turn, generate residentiary employment for each level of basic employment. Thus, the cohort survival and economic base methodologies are combined in UPED to form a complex systems model. The workings of the UPED Model and of its key data requirements are presented in Figure R-F-1. The top three boxes represent the natural increase (births and deaths), again, and the non-employment related part of the migration components of UPED's population project methodology.

The initial (year t) population, consisting of a census-type count or estimate of all people residing in the area by age and sex is adjusted to reflect the temporary absence of some individuals who are permanent residents (an increase) and/or the temporary presence of individuals who are not permanent residents (a decrease). Relevant categories here include college students, military, and LDS missionaries. The resultant estimate of the permanent resident population is then survived by applying cohort specific survival rates. The result is the subset of the initial resident population expected to still be alive the next year. Members of each cohort have aged one year. The aged-survived population is adjusted to reflect projected levels of temporary absence (a decrease) or presence (an increase) and permanent non-employment related in-(increase) and out-(decrease) migration. Total births are projected by applying a vector of age specific birth rates to the female component of this adjusted aged-survived population. Infants' sex composition and infant mortality are also projected at this stage. The result of these calculations, as shown in Box 3, is the Adjusted Natural Increase Population at Year t+1, which becomes the initial estimate of population in that year (Box 4).

The first approximation population projection is the source of two elements of Labor Market Analysis: (1) the initial (pre-employment related migration) Labor Force and (2) initial Population Dependent Job Opportunities at Year t+1 (Boxes 5 and 6, respectively). The Labor Force is derived by applying projected age and sex specific labor force participation rates to the projected population. The projected participation rates are dependent upon both extrapolations of their secular trends and year-to-year changes in area economic opportunity.

Population dependent job opportunities are projected as dependent upon (1) the size and age composition of the population, (2) projected sector specific ratios of area per capita residentiary employment to national employment per capita, and (3) projections of national residentiary employment by sector and/or national popultion by cohort. Thus, changes in the size and/or demographic composition of the population, in the capability of the area to produce goods and services for its own consumption, and/or national economic and demographic conditions can all influence the projection of each sectors population dependent job opportunities. The most critical operational assumptions here are the local-national per capita residentiary employment

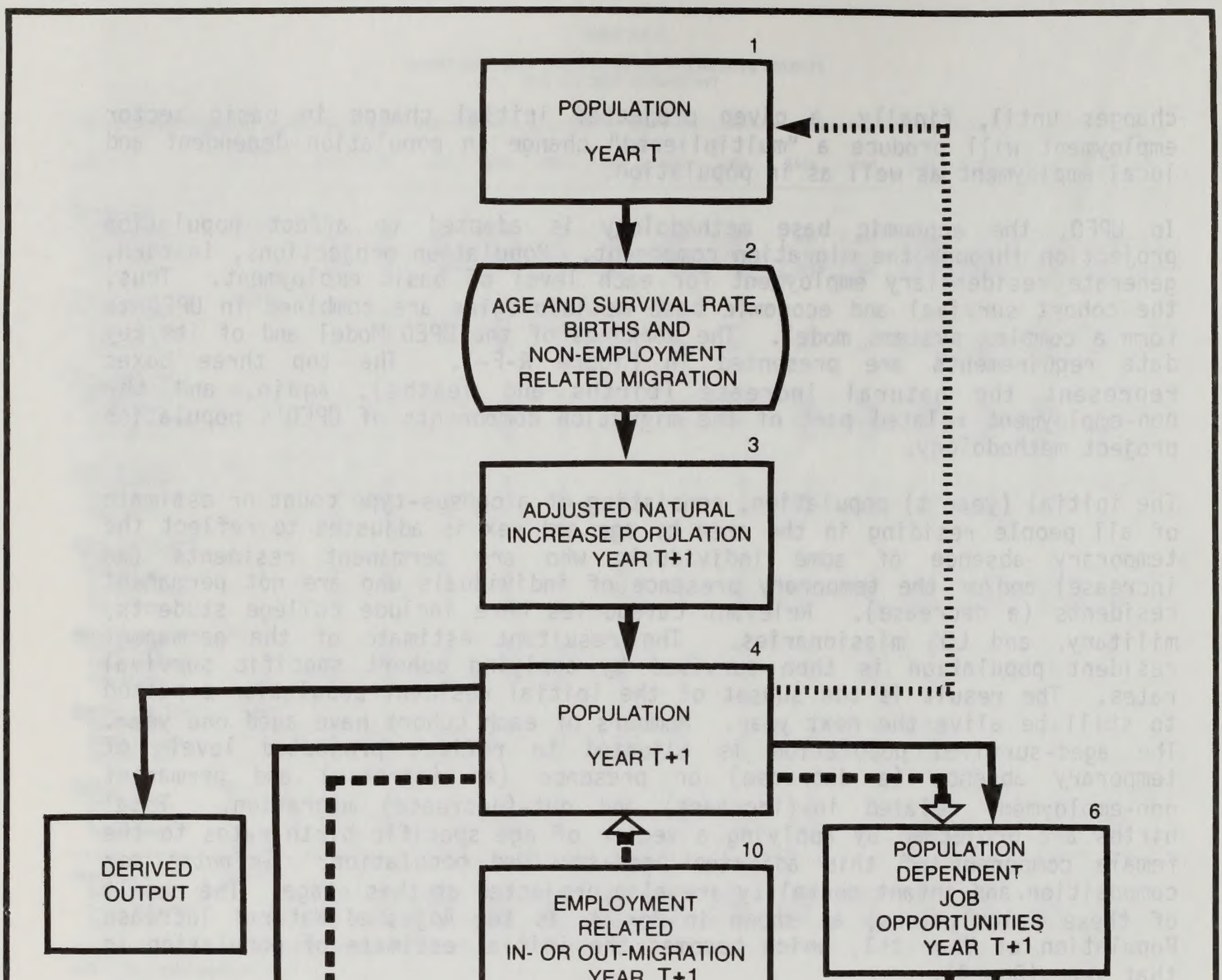

FIGURE R-F-1. UTAH PROCESS AND DEMOGRAPHIC IMPACT SIMULATION MODEL GENERAL FLOW CHART

relatives. Of special importance is the ability to adjust these assumptions to reflect structural changes as market expansion leads to import substitution possibilities.

As Box 7 indicates, basic employment demand is exogenously projected by sector and treated parametrically in UPED. These projections of basic employment are varied to reflect the different economic developments to be analyzed. For example, to project the impacts of a particular power plant, the direct basic employment by industrial sector involved in constructing and operating the plant would be added to a baseline basic employment projections and the sum would serve as the basic job opportunities input for that power plant's UPED run.

Basic and population dependent job opportunities are summed to produce Total Job Opportunities at Year t+1 (Box 8). This, initial value for both the supply of and demand for labor are introduced into the Labor Market component of UPED, where they are used to calculate the projected unemployment rate as an index of the area's economic opportunities. This rate is compared against a parametrically established "normal" range of unemployment rates. If it is higher than the upper bound of the range--the out-migration triggering rate--this is taken to indicate inadequate opportunities for the natural increase population and Employment related Out-Migration at t+1 is projected. Alternatively, if it is below the lower bound--the in-migration triggering prosperity is indicated and Employment Related In-Migration at Year t+1 is projected.

The amount of migration projected is sufficient to provide the labor force required to adjust the unemployment rate to the relevant triggering rate, assuming no change in population dependent job opportunities. The demographic detail of this migration reflects cohort difference in (1) labor force participation rates, (2) migration propensities, and (3) the composition of the source population (local population for out-migration, national population for in-migration).

Of course, the assumption stressed in the previous paragraph, that job opportunities do not change as a result of migration, is invalid. The migration of workers and their families increases or decreases population dependent job opportunities. This first short dash arrows in Figure 7 indicate the interactive nature of the UPED solution to this inter-dependence problem. The iterative process continues until the calculated unemployment rate is satisfactorily close to the relevant triggering rate, at which time solution is achieved and no further migration or employment changes are calculated. Final population, migration, and employment outputs are presented with the former being used to derive projections of households, labor force, and school age population. The solution value for projected population is then fed back into the Model (long dash arrow in Figure R-F-1 to serve as the initial population vector for the next projection year.

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Of course, the assumption stressed in the previous paragraph, that job opportunities do not change as a result of migration, is invalid. The migration of workers and their families increases or decreases population dependent job opportunities. This first short dash arrows in Figure 9 indicate the interactive nature of the UPED solution to this interdependence problem. The iterative process continues until the calculated unemployment rate is satisfactorily close to the relevant triggering rate, at which time solution is achieved and no further migration or employment changes are calculated. Final population, migration, and employment outputs are presented with the former being used to derive projections of households, labor force, and school age population. The solution value for projected population is then fed back into the model (long dash arrow in Figure R-F-1) to serve as the initial population vector for the next projection year.

This appendix provides a more thorough discussion of the methodology used to develop the air quality analysis that was presented in Chapter R-4.A.2. It is intended to provide interested readers a fairly detailed description of the rationale for model selection, including the advantages and limitations of each model used, the conditions assumed when applying the model, and the interpretation of model results. Also presented is information on wind data used, emissions inventory data and methodology, and the site-specific projects and regional visibility analysis. If additional information is desired beyond what appears in this appendix, refer to the Air Quality Technical Report (Systems Applications Inc. 1982).

WIND DIRECTION PATTERNS IN THE STUDY REGION

Figure R-G-1 compares the annual morning wind-direction frequency distribution at the 150-meter, 300-meter, 500-meter, and 1,000-meter levels at tracts Ua and Ub, Cb, and at Craig and Grand Junction. In the mornings, at all sites, there is a large variation in wind speed and direction between levels. The shape of each site's wind-direction distribution curves (shown in Figure R-G-1) is unique at the lower levels, but each merges towards the west-southwesterly upper-air flow. This demonstrates the significant effect complex terrain has on lower-level wind directions.

The distribution profiles of wind direction for each level (shown in Figure R-G-2) indicate differences in morning and afternoon wind pattern. In general, the variation in wind direction with height above the ground, is much less at all sites in the afternoon and the winds at the lower levels tend to be more westerly as are the 1,000 meter winds (which change little from the morning). This phenomenon occurs because the atmosphere is well mixed in the afternoon, and the surface winds become coupled with the steady, persistent upper-level winds.

In the afternoon at U-a/U-b, northwesterly up-slope flow (penetrating up to 500 meters) tends to occur more frequently over a deeper layer than does the morning drainage flow. Low-level wind speeds increase in the afternoon, but they still do not approach the wind speeds at C-b.

EFFECT OF TERRAIN ON WIND FIELDS

The descriptions in this section of the effect of the complex terrain (hills, mountains, and valleys) in the study region are substantiated by the wind field modeling work performed as part of this analysis. The Air Quality Technical Report (Systems Applications Inc. 1982) displays the computed wind fields for the lowest of the three atmospheric layers modeled, which is about 2,500 feet (780 meters) thick and extends from the terrain or 4,300 feet above mean sea level (MSL), whichever is highest, to 6,800 feet MSL. Winds are

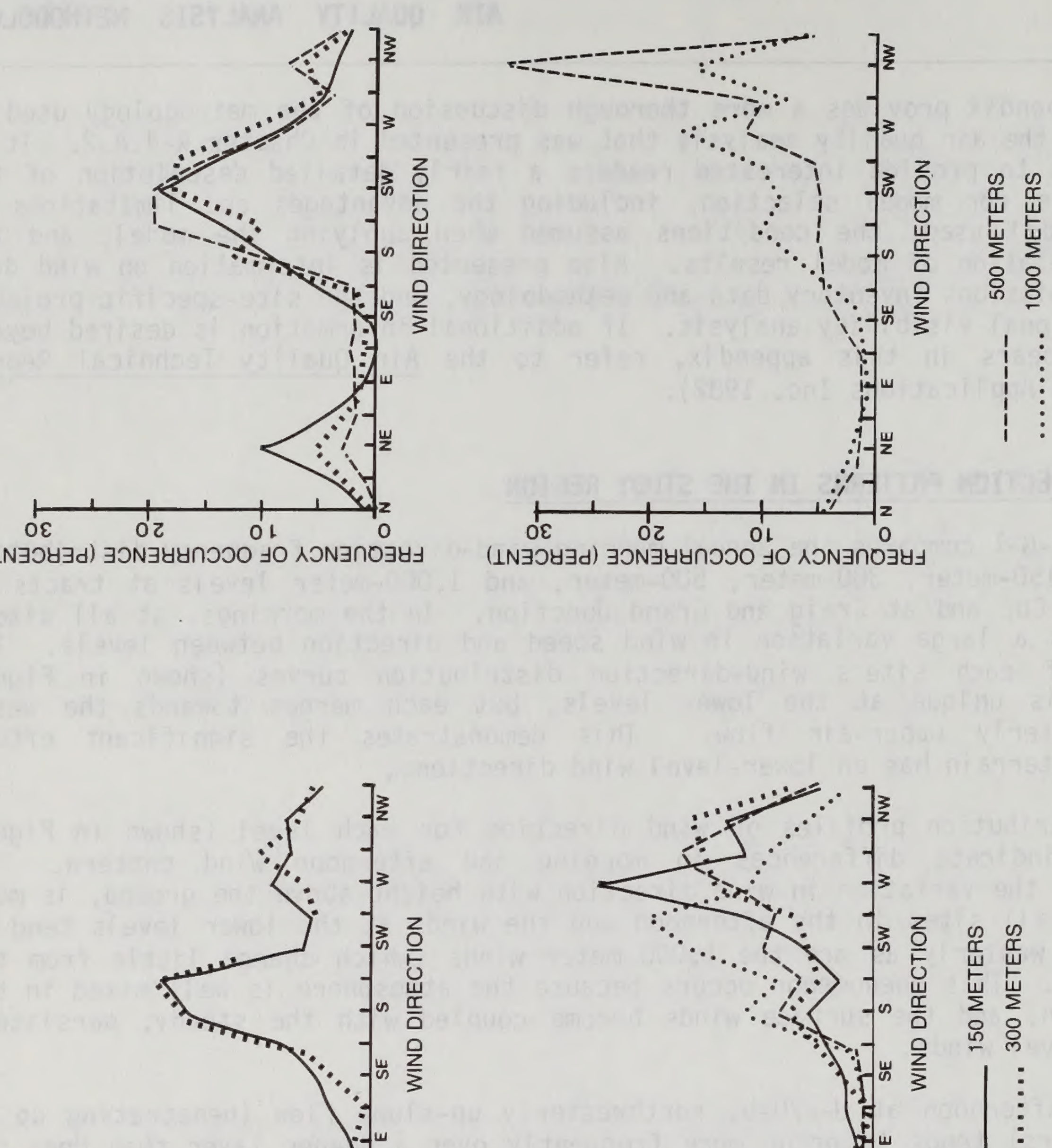

FIGURE R-G-1 WIND DIRECTION FREQUENCY DISTRIBUTIONS FOR ALL MORNING SOUNDINGS

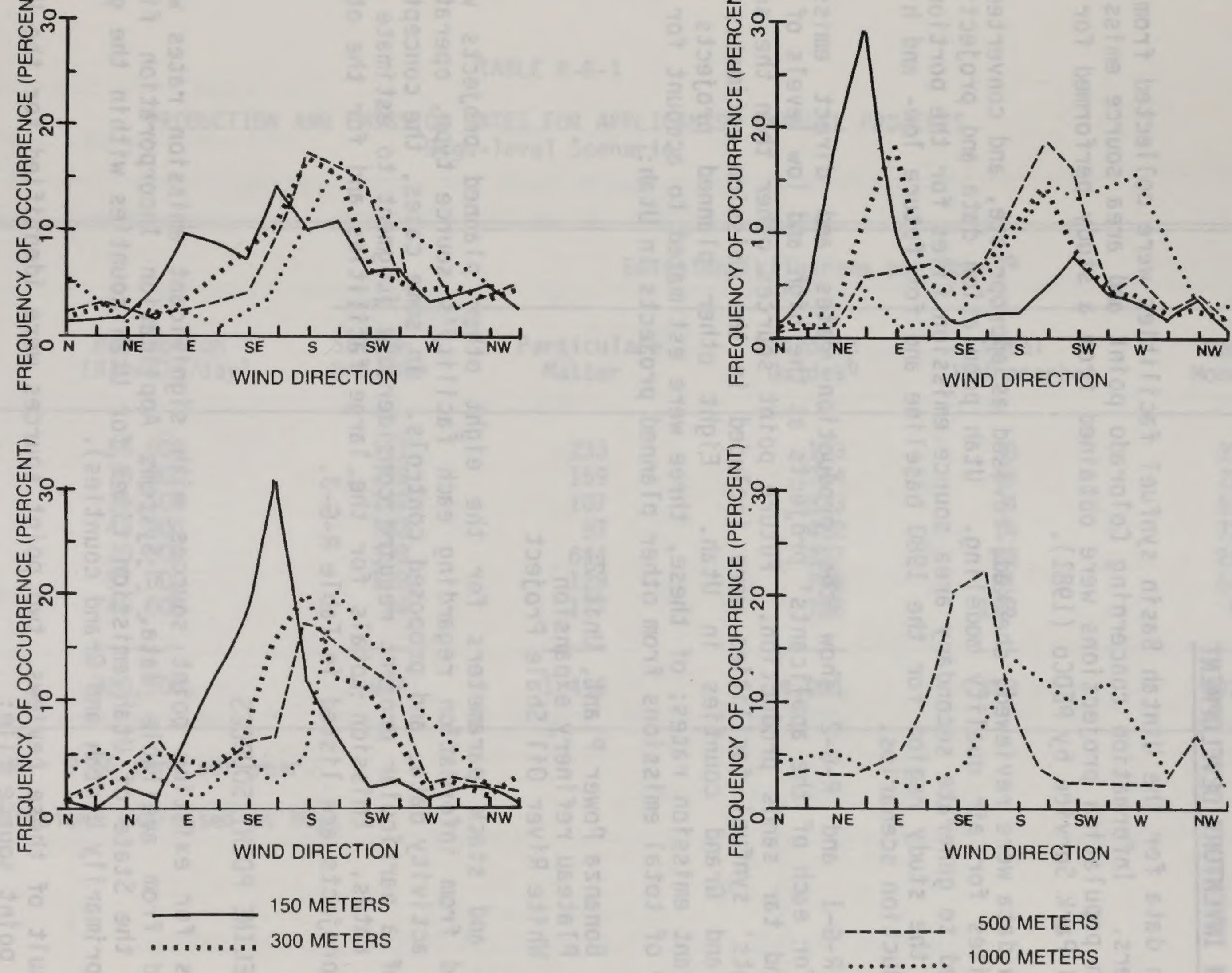

FIGURE R-G-2 VERTICAL WIND DIRECTION DISTRIBUTION PROFILES FOR ALL AFTERNOON SOUNDINGS

channeled through valleys (the White, Green, and Colorado river basins), and winds are accelerated and decelerated by the effects of complex terrain.

EMISSION INVENTORY DEVELOPMENT

Emission data for the Uintah Basin synfuel facilities were collected from the developers. Information concerning Colorado point and area source emissions and Utah population projections were obtained from a study performed for the National Park Service by PEDCo (1981).

Emission data were reviewed, checked, revised as appropriate, and converted to input files for air quality modeling. Utah population data and projections were used to generate secondary area source emission files for the portion of Utah in the study region for the 1980 baseline and for future low- and high-oil-production scenarios.

Tables R-G-1 and R-G-2 show the production rates and direct emission totals for each of the applicants' projects at the high and low levels of oil shale and tar sands production. Future point sources other than the seven applicants' synfuel facilities were included in the emission estimates for Uintah and Grand counties in Utah. Eight other planned projects had significant emission rates; of these, three were estimated to account for the majority of total emissions from other planned projects in Utah:

Bonanza Power Plant, Unit 2
Plateau refinery expansion
White River Oil Shale Project

Emission and stack parameters for the eight other planned projects were developed from information regarding each facility's source type, operating process, activity data, and proposed controls. In some cases, the conceptual nature of a particular project require considerable judgment to estimate the emission rates. Emission totals for the large facilities and for the other planned projects are listed in Table R-G-3.

UTAH BASELINE POINT SOURCES

Emissions for existing point sources with significant emission rates were developed from available data. Systems Application Incorporation first reviewed the State of Utah emission files for Utah counties within the grid region (primarily Uintah and Grand counties).

As a result of these reviews, two point sources were identified for the Utah baseline point source file:

Bonanza Power Plant, Unit 1
Plateau refinery

The first power plant unit for the Bonanza facility was placed in the existing point source file, because construction of this facility has begun. The

TABLE R-G-1

PRODUCTION AND EMISSION RATES FOR APPLICANTS' SYNFUEL PROJECTS
High-level Scenario

		Emission (kilograms per hour)[a]				
Project	Production (Barrels/day)	Sulfur Dioxide	Particulate Matter	Nitrogen Oxides[b]	Total Hydrocarbon	Carbon Monoxide
Enercor-Mono Power	55,000	111	233	123	38	33
Geokinetics	70,000	1,799	159	744	40	22
Magic Circle	31,500	147	107	823	4	53
Paraho	42,000	182	97	482	14	72
Sohio	20,000	373	644	327	88	29
Syntana-Utah	57,000	128	129	746	81	64
Tosco	45,000	94	127	786	183	9
TOTAL	320,500	2,834	1,496	4,031	448	282

[a]1 kilogram per hour = 9.66 tons per year.

[b]Nitrogen oxides emissions expressed as NO_2.

TABLE R-G-2

PRODUCTION AND EMISSION RATES FOR APPLICANTS' SYNFUEL PROJECTS
Low-level Scenario

Project	Production (Barrels/day)	Emission (kilograms per hour)[a]				
		Sulfur Dioxide	Particulate Matter	Nitrogen Oxides[b]	Total Hydrocarbon	Carbon Monoxide
Enercor-Mono Power	20,000	40	79	45	13	12
Geokinetics	31,000	764	71	331	18	12
Magic Circle	16,400	73	51	420	2	33
Paraho	10,500	45	54	105	3	21
Sohio	5,000	1	136	25	22	16
Syntana-Utah	16,500	40	38	230	18	19
Tosco	22,000	46	62	385	90	4
TOTAL	121,400	1,009	491	1,541	166	117

[a]1 kilogram per hour = 9.66 tons per year.

[b]Nitrogen oxides emissions expressed as NO_2.

TABLE R-G-3

EMISSION TOTALS FOR OTHER PLANNED PROJECTS IN UTAH
(kilograms per hour)[a]

Project	Sulfur Dioxide	Particulate Matter	Nitrogen Oxides[b]	Total Hydrocarbon	Carbon Monoxide
Bonanza Unit 2	95	55	1,012	0	0
Plateau expansion	29	44	58	245	67
White River	136	197	827	165	381
Additional Project (5)	195	80	99	93	6
TOTAL	455	376	1,996	503	454

[a]1 Kilogram per hour = 9.66 tons per year.

[b]Nitrogen oxides emissions empressed as NO_2.

existing Plateau refinery located in Duchesne County was also included because of its relatively significant emissions. Emission and stack data for the Bonanza Power Plant were taken from the EPA Prevention of Significant Deterioration (PSD) permit, whereas comparable data for the existing Plateau facility were derived from the State of Utah 1980 emission data. Table R-G-4 lists the emission data for these two facilities.

The Colorado emission estimates were used in the modeling portion of the Systems Application Incorporation study.

UTAH BASELINE AREA SOURCES

Available emission inventory data for existing area sources in eastern Utah were very limited. Consequently, it was necessary to develop this information from the available data concerning area source activities. Appropriate activity data such as fuel use by sector, agricultural operations, gasoline sales, and traffic counts were then obtained from several information sources. These data were combined with the same emission factors used by PEDCo for Colorado area sources. The result was a set of emission inventories by source category for each of the two primary Utah counties in the study region--Uintah and Grand. The inventories are generally representative of 1980 conditions. Allocation factors were used to assign emissions from each category to specific 10-kilometer-square grid cells. The emission totals for baseline area sources in Utah are shown in Table R-G-5.

COLORADO EMISSION SOURCES

Emission rates for Colorado sources in the study region appear in the Air Quality Technical Report (Systems Applications Inc. 1982). The Colorado emission rates used by Systems Applications Inc. were taken from the PEDCO (1981) report.

DESCRIPTION OF MODELING APPROACHES

In this section the approach adopted for the analysis of regional-scale air quality and visibility impacts resulting from oil shale development in the Uinta Basin and in Colorado, and from other existing and anticipated emission sources is described.

MODELING METHODOLOGY

The aim of this modeling effort was to apply the most sophisticated and realistic modeling methodology currently available. The complex dispersion processes that occur in the rugged terrain of the study region, the large size of the modeling region, and diverse temporal scales (3-hour, 24-hour, and annual averages) strain the capabilities of almost all routinely applied air quality models. The simple models (e.g., VALLEY, CRSTER, and COMPLEX), which have been previously applied to some of the proposed facilities studied here,

TABLE R-G-4

EMISSION TOTALS FOR BASELINE POINT SOURCES IN UTAH
(kilograms per hour)[a]

Project	Sulfur Dioxide	Particulate Matter	Nitrogen Oxides[b]	Total Hydrocarbon	Carbon Monoxide
Bonanza Unit 1	95	55	1,012	0	0
Plateau Refinery	4	6	432	291	62
TOTAL	99	61	1,444	291	62

[a]1 Kilogram per hour = 9.66 tons per year.

[b]Nitrogen oxide emissions empressed as NO_2.

TABLE R-G-5

EMISSION TOTALS FOR BASELINE AREA SOURCES IN UTAH
(kilograms per hour)

County	Sulfur Dioxide	Particulate Matter	Nitrogen Oxides	Total Hydrocarbon	Carbon Monoxide
Uintah	36	5,310	219	274	2,636
Grand	36	1,495	219	190	1,538

are recognized as having serious shortcomings on a regional scale in this setting; among the most serious are:

- Inability to treat spatially and temporally varying wind fields.

- Inability to treat spatially and temporally varying dispersion rates.

- Inability to properly treat the effects of topography, slope winds, and other physical processes in complex terrain (assuming instantaneous and straight-line plume transport).

- Limited ability to treat chemical transformations and removal mechanisms.

Furthermore, the model applications carried out thus far have not been extensive (i.e., allowing the assessment of cumulative impacts from all proposed developments) or consistent enough to contribute to a comprehensive impact assessment.

To achieve the study objectives, a modeling methodology was selected to assess cumulative impacts of future oil shale and other associated and nonassociated development on a regional scale, resolved to averaging periods of 3 hours, 24 hours, and 1 year, within the states of Colorado and Utah. The methodology selected is based on the utilization of several sophisticated component models: the Systems Applications Inc. Complex-Terrain Wind Model, the Systems Applications Inc. Gaussian Puff Model, the Systems Applications Inc. Regional Transport Model, the EKMA model, and the Systems Applications Inc./EPA PLUVUE model. In addition, EPA's COMPLEX-I model was applied for calculations of concentrations very near emission sources. Each model component was intended to serve a purpose that is specific to the strengths of its particular formulation and that complements the strengths of the other components. Descriptions of the rationale behind the use of each model and the way each is used are given below.

<u>Use of COMPLEX-I</u>

- It is a model developed by EPA, and is currently being evaluated by that agency.

- It is relatively inexpensive and simple to apply.

- A meteorological data base was available for its application.

- Near the source, its formulation is nearly equivalent to those of more sophisticated and expensive models.

Further, from the source (beyond 5 to 10 km), some well-known deficiencies of COMPLEX-I and othe Gaussian plume models become limiting, especially in rugged terrain such as the terrain in the study area. Among the more serious of these deficiencies are:

- Assumptions of spatially constant winds and dispersion.

- Assumption of instantaneous transport.

More sophisticated models are required to overcome those deficiences at moderal to long transport distances.

For Utah sources, COMPLEX-I was applied using 1978 U_a-U_b 10-meter tower wind and delta data. The seasonal and diurnal variations in mixing depths suggested by Holzworth (1972) were used to construct an hourly mixing depth input for Utah and Colorado sources. For Colorado sources, the 1975 C_b or 1975 C_b 10-meter tower data (wind and delta T) were used, depending on the location of each emitting facility in relation to the measurement sites.

Use of the Complex-Terrain Wind Model (CTWM)

CTWM utilizes surface and upper air wind data as well as information on stability, terrain, surface roughness, and temperature distribution to generate three dimensional wind flow fields, taking into account physical processes which occur in complex terrain. Upper air data from Salt Lake City, Denver, Lander, and Grand Junction and surface wind data from four Ua-Ub sites were used.

Surface winds measured at several sites in the modeling region during 25 randomly selected hours during 1978 were compared with the corresponding winds predicted by the model. The comparison showed that the predicted surface wind directions were within 45^o of the measured wind directions on all but two occasions. Predicted wind speeds were within 30 percent of the measured wind speeds in all but four instances where they were within 60 percent of the measured speeds.

Use of the Gaussian Puff Model

The Gaussian Puff Model (GPM) was used with CTWM generated wind fields to overcome some of the major shortcomings of COMPLEX I for medium to long transport distances. GPM was used because of its capability to accommodate spatially and temporally varying wind fields and dispersion rates and CTWM's capability to provide a better definition of winds in complex terrain. GPM was run on a regional scale (268 x 180 km) and a subregional scale (110 x 110 km) using CTWM modeled winds for every 3-hour period in 1978. The regional scale model runs used a 12 km grid spacing, 3-hour time steps and Pasquill D stability class. The subregional model runs used a 5 km grid spacing for better resolution close to the emission sources, 1-hour time steps and time varying stability.

Use of the Regional Transport Model (RTM)

RTM was used for calculation of worst-case short-term regional scale concentration averages because it is better suited than GPM for treating the dispersion of pollutants from many sources over long transport distances and

times. RTM is more physically realistic than GPM because RTM allows for variations in wind and diffisinity across a puff, whereas GPM cannot. RTM was too costly to run for an entire year, so its purpose was to provide estimates of short-term (3-hour and 24-hour) concentration averages for the worst-case episode identified by GPM when run for an entire year. RTM was run in 1-hour time steps for a 268 x 180 km region with 4-km grid spacing for the 48-hour worst-case episode identified by GPM. CTWM was run in a hourly mode to generate the wind data for the 48-hour period.

Use of the Empirical Kinetic Modeling Approach (EKMA)

EKMA was used to study photochemical pollutants (ozone) impacts due to secondary development associated with the synfuels development. For this analysis, a modified version of EKMA was used to account for chemical reactions in rural areas which involve largely methane, carbon monoxide, and trace organics such as naturally occurring terpenes.

Estimation of Baseline TSP Levels

For most of the monitoring locations in the study area, TSP ambient air quality standards are exceeded. The primary cause of these exceedances is most likely windblown dust and dust from unpaved and gravel roads.

Utilizing the TSP emission inventory developed for the study region, Systems Applications Inc. looked at the emissions in locations for which they had TSP ambient data. A high correlation between local TSP emissions and ambient concentrations was found. On the basis of these correlations, Systems Applications Inc. developed empirical models to calculate the existing baseline ambient TSP concentrations for the study region. The 24-hours and annual average isopleth maps are shown in the technical report. Ambient-annual average TSP concentrations in excess of the air quality standards are predicted to exist in the Colorado River basin (near Grand Junction and Rifle) in the southeastern portion of the study region, and near Craig, Colorado, and Vernal, Utah. Systems Applications Inc. estimated that annual-average TSP concentrations in most other sites in the study area are currently in the range of 20 to 40 ug/m^3. Maximum 24 hour average concentrations were predicted to be higher than the NAAQS for much of the study region.

Concentration Estimation Approach

A variety of modeling approaches were used in the analysis of regional air quality impacts. For ground-level concentration estimates, the Gaussian Puff Model (GPM) was exercised for every 3-hour period in an entire year based on regional meteorological conditions in the region. The GPM results were used to identify for each gridded receptor in the region the maximum 3-hour and 24-hour concentrations (occuring at differenct times at diffent receptors) and the annual average concentrations. The maximum concentrations thus identified are expected to be upper-bounds estimates of the future maximum concentrations in the region for a number of reasons.

The expected conservatism of the Gaussian Puff Model is due to several factors.

Puffs are diffused assuming Pasquill D dispersion coefficients; this is conservative at long range (greater than 25-50 km). Considerable dispersion results from the effects of complex terrain on turbulence. Complex terrain considerably enhances plume dilution. Also, additional dilution is expected to result from daytime heating and resulting convective mixing throughout the mixed layer. These processes rapidly result in uniform vertical mixing throughout the mixed layer (the convective boundary layer) which is typically 1,000 meters to over 4,000 meters thick. By comparison, the vertical dispersion coefficient for Pasquill D stability at 50 km is 320 meters. Dispersion conditions during the daytime are typically Pasquill A, B, or C. The difference of just one stability class (from Pasquill D to C) is a reduction in short-term concentrations by a factor of more than 5 and in annual averages by a factor of more than 2.

Puffs are assumed to be transported by the portions of the wind field that are at the centroid of puff mass. This assumption is conservative at long distances where puffs are large because a complex wind field will tend to transport different portions of the puffs in different directions. This effect is much larger than the dilution resulting from the small-scale turbulence that is accounted for in the Pasquill scheme.

The GPM model results are also conservative for near-source impacts (less than 25 km) where there are multiple, ground-level releases of emissions at a given facility (e.g., TSP). In this analysis because of cost considerations multiple emissions (there are as many as 30 TSP emission sources at oil shale facilities) are treated as emissions from a single point in the center of the emission source. To more rigorously model the near-source impacts of multiple ground-level emissions, COMPLEX-I was used.

Furthermore, wind field definition in GPM is based upon upper level wind characterization, which is appropriate for long-range transport. For short-range, near-source calculations lower-level or surface winds are more appropriate, and these exhibit a larger amount of temporal variatiability than upper level wind and hence would result in lower concentration averages. An even greater degree of conservatism is added to GPM by allowing puff centroids to approach high terrain features to within one-half their effective release heights, even under the assumed neutral stability conditions. One would expect this to occur in reality only under stable conditions, while in neutral and unstable conditions puffs should remain near their effective release heights.

Another way to evaluate the potential conversion of GPM is to compare GPM results with other regional models that are expected to be more realistic. One such comparison was performed for a day (July 27, 1978) in the year modeled with GPM that resulted in the highest 24-hour average SO_2 concentration in the vicinity of the Flat Tops Wilderness. This 24-hour SO_2 concentrations was predicted by GPM to be 19 ug/m^3 and to occur to the west of Flat Tops. (The highest model SO_2 24-hour concentration within Flat Tops

occured on October 20, 1978, and was 12 ug/m^3). The Regional Transport Model (RTM) was exercised for the meteorological conditions on this July 27, 1978, day.

GPM calculated a maximum concentration in Flat Tops greater than 6 ug/m^3 on this day, while RTM calculated impact of about 1 ug/m^3. For the receptor in the vicinity of Flat Tops for which a 19 ug/m^3 impact was calculated by GPM, RTM calculated an impact between 1 and 2 ug/m^3. The maximum near-source concentration in the entire region calculated by GPM was 5 ug/m^3, which occurred near the White River Oil Shale Project (Ua, Ub) in Utah. RTM calculated a maximum concentration at this location and 20 km to the north of 41 ug/m^3. These calculated impacts near the White River Oil Shale Project may be unrealistically high because in both the GPM and RTM models multiple ground level SO_2 emission sources throughout the facility were combined into a single point source. Maximum near-source concentrations calculated by both models in the Piceance Basin are near Cathedral Bluffs; GPM calculated a maximum concentration of 20 ug/m^3, and RTM calculated 16 ug/m^3. Although one should be careful in generalizing from results of a model comparison for just one worst-case day, it tentatively can be concluded that GPM and RTM compare quite favorably for near-source maximum impacts, but GPM calculates considerably greater impacts than RTM at distances beyond about 25-50 km.

To account for the expected conversion of GPM, air quality impacts have been projected by using ranges of concentrations, with the GPM predictions being the upper bound of that range. The size of this range is an order of magnitude (a factor of 10) for the maximum 3-hour and 24-hour concentrations. This range is based on professional judgement of the uncertainty of concentration estimates and a belief that GPM calculations are certainly conservative (i.e., that maximum concentration estimates on the basis of GPM would be greater than actual concentrations). The GPM model is expected to be less conservative for annual averages than for short-term averages because underestimates of horizontal dispersion are cancelled out in the process of averaging concentrations over an entire year. It is still expected to be conservative because GPM underestimates vertical dispersion. The empirical model used to calculate TSP concentrations from area source emission densities is expected to be unbiased but could underestimate or overestimate actual concentrations by an estimated factor of 2.

Any conclusions above the magnitude and significance of air quality impacts should be made recognizing that model estimates of regional impact are uncertain to this degree at this time.

Visibility Analysis Methodology for Site Specific Projects

An EPA Level-1 visiblity screening test was done for each site specific project to determine the potential for significant visibility impairment at Dinosaur and Colorado National Monuments, the proposed High Uintas Wilderness Area, the Uintah and Ouray Indian Reservation, and Flat Tops Wilderness Area. EPA Level-1 tests were also performed for the regional analysis. The Level analysis allows one to determine the likelihood that visiblity impairment will be considered to be adverse. This analysis functions as a screening test in

that it overestimates (by design) impacts to the extent that if the test is passed, there is little possibility that significant visibility impairment will take place.

Level-1 screening contrast parameters (C_1, C_2, C_3) were calculated to indicate potential problems for three scenarios: a dark (NO_2) plume visible against the sky, a light (particulate) plume visible against terrain, and regional reductions in terrain/sky contrast and visual range. The Air Quality Technical Report (Systems Applications Inc. 1982) summarizes the results. If any of these contrast parameters is greater or less than -0.1, a potentially adverse problem cannot be ruled out.

A more detailed assessment considering possible atmospheric discoloration at Dinosaur National Monument and the Uintah-Ouray Indian Reservation was also performed for each site specific project, conceptual projects, and baseline and interrelated sources. Values of delta E, an indicator of the perceptibility of atmospheric discoloration resulting from nitrogen oxide emissions, were calculated for the Dinosaur National Monument Visitors Center and the Uintah and Ouray Indian Reservation. Delta E was estimated for three meteorological conditions most likely to cause impacts; F (very stable), E (stable), and D (neutral) stabilities with light wind speeds of 2.5 meters/ second and a wind direction that would transport the plume directly toward the area of interest. Next, the frequency of occurence of each meteorological condition was estimated. This was done using joint frequency distribution of wind speed, wind direction, and stability developed at plume height for the Moon Lake (Deseret) Power plant (Burns and McDonnell 1980). The joint frequency analysis was developed using pilot balloon and temperature sonde data collected at the Ua-Ub tracts. The pilot balloons with temperature sondes attached were released every other day at 1/2 hour after sunrise and at 2 p.m. local standard time from October 1976 to January 1978.

The cumulative frequencies of occurrence of delta E values are shown in Tables R-G-6 and R-G-7. It is estimated that the threshold of perceptibility of atmospheric discoloration ranges from about a delta E of 1 to a delta E of 4, depending upon the sensitivity of the observer. The frequency of occurrence of delta E's greater than 4 and the frequency of delta E's greater than 1 was estimated. The range of number of days per year of perceptible discoloration given in Chapter 4 of each site specific was the difference between the number of mornings or afternoons per year with delta E's between 1 and 4. For example, if it were estimated that a delta E of 4 or greater would occur 5 mornings per year and a delta E of 1 or greater would occur 15 mornings per year, the frequency of perceptible discoloration would be given as 5 to 15 mornings per year.

Regional Haze Analysis Methodology

Worst-case impacts of regional emissions on visual range would be seen with the simultaneous occurrence of:

TABLE R-G-6

MAGNITUDE (DE) AND CUMULATIVE FREQUENCY (cf)*
OF PLUME DISCOLORATION FOR AN OBSERVER
LOCATED IN DINOSAUR NATIONAL MONUMENT

Emission Source	F Stability			E Stability			D Stability		
	DE,	cf mornings	afternoons	DE,	cf mornings	afernoons	DE,	cf mornings	afternoons
Enercor	0.6	6	0	0.3	18	3	0.2	19	6
Geokinetics									
Agency Draw	1.1	4	0	0.6	10	2	0.3	12	7
Lofreco	0.3	8	0	0.2	20	3	0.1	21	6
Magic Circle	4.2	4	0	3.1	10	2	1.7	12	7
Moon Lake 1 and 2	10.5	8	0	8.3	20	3	4.9	21	6
Paraho	2.4	4	0	1.8	16	3	1.0	17	6
Sohio	1.6	1	1	1.4	6	2	1.1	8	7
Syntana-Utah	3.9	4	0	3.1	16	3	1.8	17	6
Tosco	4.0	4	0	2.9	10	2	1.6	12	7
White River	4.2	6	0	3.1	18	3	1.7	19	6

* Days per year.

TABLE R-G-7

MAGNITUDE (DE) AND CUMULATIVE FREQUENCY (cf)*
OF PLUME DISCOLORATION FOR AN OBSERVER
LOCATED IN THE UINTAH AND OURAY INDIAN RESERVATION

Emission Source	F Stability			E Stability			D Stability		
	DE,	cf mornings	cf afternoons	DE,	cf mornings	cf afernoons	DE,	cf mornings	cf afternoons
Enercor	0.6	0	0	0.5	6	2	0.3	7	3
Geokinetics									
Agency Draw	1.1	4	0	0.9	10	2	0.5	12	7
Lofreco	0.3	0	0	0.2	7	2	0.1	7	3
Magic Circle	4.2	3	1	3.3	8	2	2.7	10	7
Moon Lake 1 and 2	8.9	1	0	8.0	3	1	6.7	3	1
Paraho	2.5	0	0	2.1	7	2	1.4	7	3
Sohio	1.7	0	1	1.4	2	2	0.9	2	2
Syntana-Utah	3.9	0	0	3.3	3	2	2.1	4	7
Tosco	3.1	4	0	2.8	10	1	2.5	12	1
White River	4.3	0	0	3.6	2	1	2.4	3	2

* Days per year.

- Low wind sppeds (stagnant conditions).

- Low mixing heights

- High insolation (to maximize sulfate aerosol formation rates).

- Wind directions that permit an air parcel to pick up emissions from many sources.

- Lack of significant precipitation (which would wash out aerosols).

It is difficult to find periods in the study during which all these conditions occur simultaneously. For example, stagnation events, with low wind speeds, low mixing heights, and no significant precipitation are most common in winter when solar insolation and fugitive dust emissions are at their minimum annual values. Holzworth (1972) found that in Grand Junction, on average, there are six episodes of two days or more each (a total of 26 days) with no significant precipitation, mixing heights less than 1,000 m, and wind speeds less than 4 m/s. These episodes occur primarily in winter. In summer, when insolation is at a maximum, mean afternoon mixed layers are 3,900 meters thick, and wind speeds are about 6 m/s.

Although it must be noted that it is possible that significant regional visual range reduction would occur in the winter in populated areas due to fireplace and stove emissions trapped in stagnant layers, the magnitude of such impacts is difficult to quantify at this time.

A summertime worst-case meteorological scenario for evaluation of regional visual range reduction was selected. A conservatively low summertime mixing height of 1,000 meters and a low wind speed of 3 meters per second were chased. It was assumed that an air parcel was transported over the population centers and synfuel development areas of the Uintah and Piceance basins picking up emissions as it progressed eastward. Unlike plume discoloration effects, regional visual range reduction increases with transport time and the rate of plume mixing with reactive background species (primarily the hydroxyl radical). A C stability for plumes (trapped within the 1,000-m mixed layer) and a long transport time of about 10 hours for Uintah Basin emissions were selected. Impacts were evaluated for a line of sight northwest from Flat Tops. It is possible that somewhat larger reductions in visual range than those calculated here could occur further downwind in Mount Zirkel and Rocky Mountain National Park because of longer transport and reaction times. However, it is unlikely that impacts in these areas would be much larger, because at these more significant distances the mixed layer is likely to be deeper and much of the plume aerosol and its precursors would be deposited in a dry mode or in a wet mode during afternoon thunderstorms that are common at higher elevations.

Although regional visibility impacts deserved more detailed study than what is possible to present here, it is believed that a reasonable worst-case scenario has been identified.

PLUVUE model calculations were used to calculate percentage reductions in visual range. These percentage reductions are independent of the baseline visual range assumed. A background ozone concentration of 43 ppb was assumed. The model runs were not performed separately for each point source. All the oil shale source emissions for the Uintah Basin were summed and modeled using ony plume, and the width of the initial plume was set at 10 km. (It should be noted that a sensitivity study of PLUVUE has shown that specification of horizontal plume dispersion is not critical to visibility predictions.) As noted above, the stability class within the 1,000-m mixed layer was set to Pasquill-Gifford "C" stability. Separate model runs were performed for synfuel facilities in the Uintah Basin and in Colorado, for other point sources in the Uintah Basin and in Colorado, and for fugitive particulate emissions in the Uintah Basin, and Rio Blanco and Moffat counties in western Colorado.

Specification of the size distribution of the aerosol is very important in obtaining accurate estimates of visibility impacts due to scattering by particulate matter or secondary aerosol. Size distribution specified by EPA (1981) were used. The only area source emissions considered were emissions of fugitive dust (TSP) from unpaved roads, which amount to more than 90 percent of the total area source TSP emissions

A PLUVUE model simulation was performed for each source type, level of emissions, and location. For each simulation, the reduction in visual range from the background value was determined for an observer at the Flat Tops Wilderness Area looking toward the northwest horizon sky. The total visual-range reduction was obtained by adding the fractional visual-range reductions for all the different sources. The visual-range reductions are 2.86 percent, 7.25 percent, and 9.48 percent for the 1980 baseline year, and for the low- and high-oil-shale-production scenarios, respectively.

Most of the visual-range reduction in the worst-case scenario results from sulfate aerosol formed from SO_2 emissions from oil shale facilities and other point sources. Little of the visual-range reduction is due to secondary emissions associated with population growth.

Acid Deposition

In watershed soils which are alkaline (containing limestone or bicarbonates) to buffer or neutralize incoming acid deposition, lakes and streams will be acidified less rapidly and aquatic communities will be less susceptable to harm. Much of the lower elevation area within the area of concern in this EIS is made up of alkaline, buffered, calcareous soils. Areas most sensitive to acid deposition appear to be those with hard crystalline bedrock and very thin surface soils.

Because of the soil parent material of these areas, there is an absence of limestone or bicarbonates resulting in an absence of buffering properties. Under these conditions, acid deposition will have a more direct access to surface waters, which may also be poorly buffered. Montane areas in the West (such as the Uinta Mountains in Utah and the western slope of the Rocky

Mountains in Colorado which have many of these characteristics) may be areas where acid deposition effects would first express themselves. These areas typically have higher precipitation rates with annual averages ranging from 30 to 60 inches above 7,500 feet compared with 8 to 15 inches below 5,500 feet. Much of the precipitation is in the form of snow or drizzles, which are efficient atmospheric scrubbers. Much of the biomass is made up of lower plant forms (rock and soil lichens, algae, and mosses), which are efficient accumulations; in many areas the soil mantle is thin, made up of crystalline parent material low in limestone and carbonates. Soils in some of these areas are acidic and may be poorly buffered. These areas are also of concern because they make up a good portion of the watershed in many areas.

Because the oil shale developments would be additional source of sulfur dioxide and nitrogen oxides, an analysis of potential acid deposition that might result from the facilities and associated activities was performed, recognizing the uncertainties involved but attempting to take a worst-case, first approximation approach.

For the high-level scenario, dry deposition in the area of influence was estimated from annual average concentration isopleth maps. The annual dry deposition was determined through miuliplication of the annual concentration by the deposition velocity, which for sulfur dioxide and nitrogen oxides was estimated to be on the order of 1 cm/sec. (Figures R-4-2 and R-4-3 (included in Section R-4.A.2, Air Quality, in the main body of this EIS) summarize these calculations.) Since these plots were derived from GPM calculations, they are expected to be conservative.

Systems Applications Inc. (1982) estimated dry deposition in the study region from annual-average concentration isopleth maps. The annual dry deposition was determined through multiplication of the annual-averge concentration by the deposition velocity, which for SO_2 and NO_x was assumed to be on the order of 1 cm/sec. Figures R-4-4 and R-4-5 summarize these calculations. Since these plots were derived from GPM calculations, they are expected to be conservative.

Wet deposition was estimated from precipitation statistics for Grand Junction and the surrounding region. Grand Junction has 69 days per year during which precipitation is greater than 0.01 inch, and has a total annual precipitation of 8.4 inches. However, higher elevations receive greater amounts of precipitation. For example, annual precipitation in the Flat Tops Wilderness Area is estimated to be as high as 40 to 50 inches. Assuming conservatively that virtually all SO_2 and NO_x is scavenged in significant rainfall events, SAI estimated that annual wet deposition rates would be on the same order as dry deposition rates, though short-term wet deposition rates would be higher. SAI considers these estimates to be conservative--extremely conservative in the low-elevation areas that receive less precipitation than the high-elevation areas. Thus, these wet deposition estimates are upper-bound estimates. Wet deposition clearly deserves more detailed study.

Wet deposition was estimated by calculating an annual effective deposition velocity by assuming that all emissions in the mixed layer throughout the region are deposited during one-hour precipitation events on the 69 days per

year with meaured precipitation in Grand Junction of 0.01 inch and greater. This is expected to be very conservative since it is unlikely that significant fractions of the atmospheric loading would be removed during light precipitation events.

Assuming an annual average mixing depth of 2,600 m (Holzworth 1972) and the complete atmospheric cleansing during the one-hour precipitation event on each of 69 days per year, we calculated the following effective, annual-average wet deposition velocity:

$$V_d = \frac{(2{,}600 \text{ m})\ (100 \text{ cm/m})}{(69 \text{ hrs})\ (3{,}600 \text{ s/hr})} = 1.05 \text{ cm/s}$$

This deposition rate is about equal to that for dry deposition. SAI feels that over the course of a year the pattern of wet deposition would be similar to that for dry deposition. It should be noted again that at lower elevations wet deposition is unlikely to be as great as that calculated here.

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VISUAL RESOURCE MANAGEMENT METHODOLOGIES

The BLM's Visual Resource Management (VRM) system and the FS's Visual Management System (VMS) were used to analyze the landscape which the proposed actions and alternatives would traverse.

To compare the visual impacts of the proposed projects and their alternatives, the VRM system was applied to lands managed by the BLM, as well as other federal lands (other than national forest lands for which the VMS procedure was applied), and state, local, Indian, and private lands.

The following three sections describe the VRM system, the VMS, and the BLM contrast rating procedure. A further explanation of each process may be found by referring to the sources used as a basis for the discussion.

THE BLM VISUAL RESOURCE MANAGEMENT SYSTEM

The VRM system is an analytical process that identifies, sets, and meets the objectives for maintaining scenic values and visual quality (BLM 1978, 1980).

The system is based on research that has produced ways of assessing aesthetic qualities of the landscape in objective terms. Aesthetic judgments considered extremely subjective were found to have identifiable, consistent qualities that can be described and measured. Whatever the terrain and whoever the observer, perception of visual quality in a landscape seems to be based on three common principles:

- Landscape character
- Influence of form, line, color, and texture
- Visual variety

Landscape character is primarily determined by the four basic visual elements of form, line, color, and texture. Although all four elements are present in every landscape, they exert varying degrees of influence. The stronger the influence exerted by these elements, the more interesting the landscape. The more visual variety in a landscape, the more aesthetically pleasing the landscape. Variety without harmony, however, is unattractive, particularly if alterations (cultural modifications) are made carelessly.

The VRM system (see Figure R-H-1, for flow diagram) involves a four-step process: 1) determining the scenic quality of a landscape, 2) measuring the visual sensitivity of an area, 3) determining distance zones, and 4) compiling all the information into management classes for guidance in assessing environmental impact (Figure R-H-1).

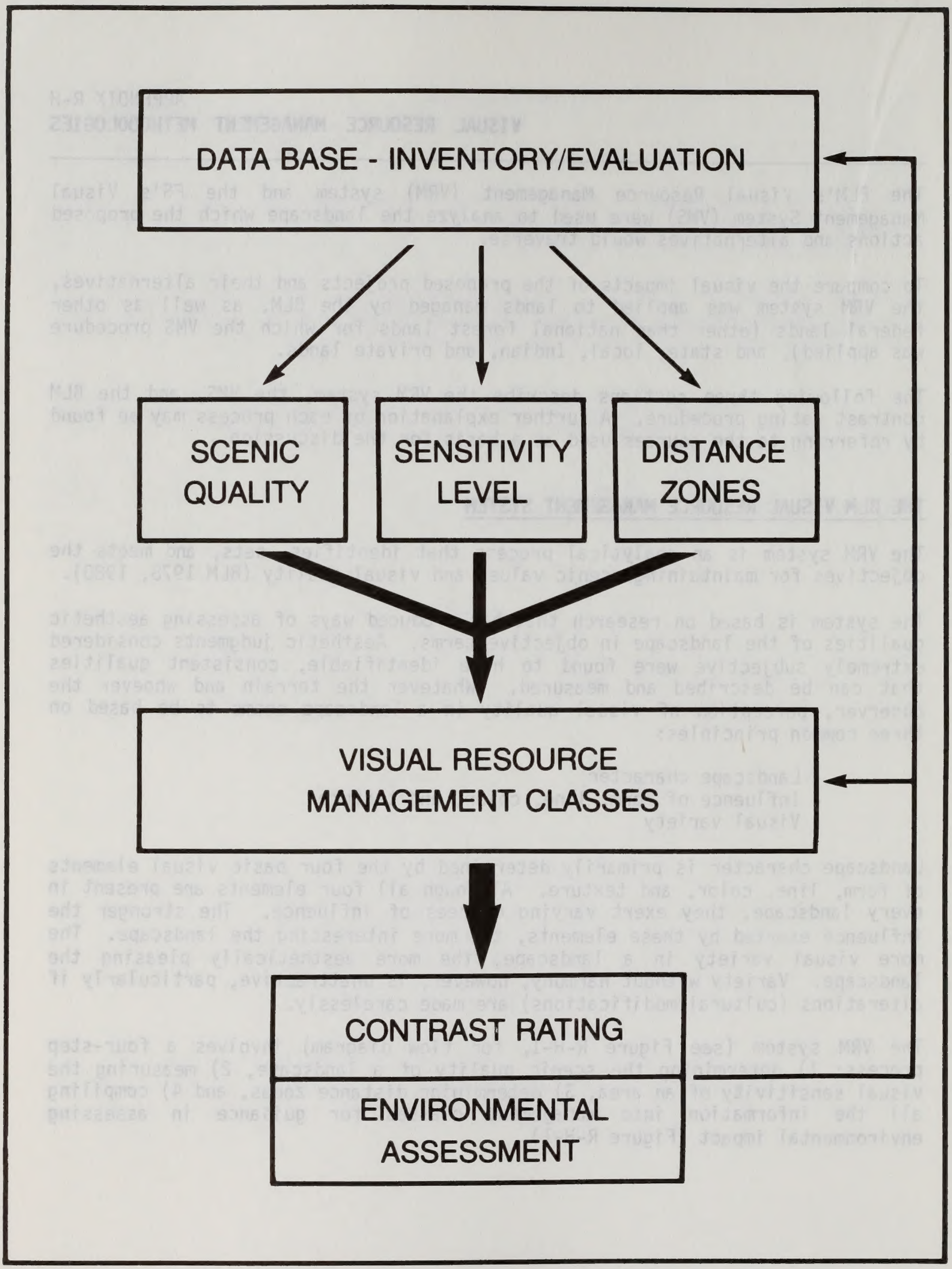

FIGURE R-H-1 THE VISUAL RESOURCE MANAGEMENT SYSTEM PROCESS

SCENIC QULAITY

Scenic quality is perhaps best described as the overall impression retained after driving through, walking through, or flying over an area of land. In the VRM process, rating scenic quality requires a brief description of the existing scenic values in a landscape.

When inventoried, an area is first divided into subunits that appear homogeneous, generally in terms of landform and vegetation. Each area is then rated by seven key factors: landform, vegetation, water, color, influence of adjacent scenery, scarcity, and cultural modification. A standardized point system assigns great, some, or little importance to each factor. The values for each category are calculated and, according to total points, three scenic quality classes are determined and mapped:

Class A--Areas that combine the most outstanding characteristics of each rating factor.

Class B--Areas which combine some outstanding features and some that are fairly common to the physiographic region.

Class C--Areas where the features are fairly common to the physiographic region.

SENSITIVITY LEVELS

Although landscapes have common elements that can be measured, there is still a subjective dimension to landscape aesthetics. Each viewer brings perceptions formed by individual influences, culture, visual training, familiarity with local geography, and personal values.

To measure regional and individual attitudes in evaluating a landscape, visual sensitivity is determined in two ways:

Use Volume

Frequency of travel through an area (by road, trail, and river) and use of (for recreation, camping, and events) of are tabulated. The area is then assigned a high, medium, or low rating according to predetermined classifications.

User or Public Reaction

Public groups are familiarized with the area (if necessary) and asked to respond to activities that will modify that landscape. The concern they express about proposed changes in scenic quality is also rated high, medium, or low.

The various combinations of use volume and user reaction for each are converted by a matrix to an overall sensitivity rating of high, medium, or low. A map is then developed that illustrates these sensitivity levels.

DISTANCE ZONES

The visual quality of a landscape (and user reaction) may be magnified or diminished by the visibility of the landscape from major viewing routes and key observation points.

A landscape scene or 'seen area' can be divided into three basic distance zones: 1) foreground/middleground, 2) background, and 3) seldom-seen. Because areas that are closer have a greater effect on the observer, such areas require more attention than do areas that are farther away. Distance zones allow consideration of the proximity of the observer to the landscape.

Selection of the key viewing points and accurate assessment of distance zones require some judgment. Where several viewing routes exist, what is foreground from one route may be background from another. In that case, the more restrictive designation is used. Atmospheric conditions may also modify the perception of distance.

The process culminates in a final distance zone map.

MANAGEMENT CLASSES

Management classes describe the different degrees of modification allowed to the basic elements of the landscape. Class designations are derived from an overlay technique that combine the maps of scenic quality, sensitivity levels, and distance zones. The overlays are used to identify areas with similar combinations of factors. These areas are assigned to one of five management classes according to predetermined criteria. The resulting map of contiguous areas sharing the same VRM class is used to assess the visual impact of proposed development.

The five classes are:

Class I

This class provides primarily for natural ecological changes; management activities are to be restricted and are not to attract attention.

Class II

Changes in basic elements by management activities should not be evident in the characteristic landscape.

Class III

Contrasts to the basic elements may be evident and begin to attract attention, but they should remain subordinate to the existing characteristic landscape.

Class IV

Alterations may attract attention but should repeat the form, line, color, and texture characteristics of the landscape.

Class V

Rehabilitation is needed to restore the landscape to the character of the surrounding landscape.

THE FS VISUAL MANAGEMENT SYSTEM

The VMS establishes criteria for identifying and classifying scenic qualities and aesthetic concern for those qualities on national forest lands (FS 1974). The process establishes quality objectives for altering the visual resource by recognizing the great variation in visual strength of the various types of natural landscape and their inherent capabilities to accept change.

In this process, a particular landscape is placed within a framework for analysis. (See Figure R-H-2 for diagram.) The framework is the character type or common distinguishing visual characteristic of landform, water forms, and vegetative patterns based upon physiographic regions as defined by Nevin M. Fenneman (1981). The characteristic landscape is the naturally established landscape being viewed; it serves as the final basis for analyzing and comparing the appropriateness of a management activity against the prescribed VQO (Figure R-H-2).

The VQO incorporates the extreme variability of the land's scenic quality, the visual sensitivity of the land, and the ability of various forest landscape to undergo alteration.

VARIETY CLASSES

Variety classes are obtained by classifying landscapes into those where the scenic quality is most important and those where it is of lesser value. The classification is based on the premise that all landscapes have some value, but those with the most variety or diversity have the greatest potential for high scenic value. There are three variety classes which identify the scenic quality of the natural landscape:

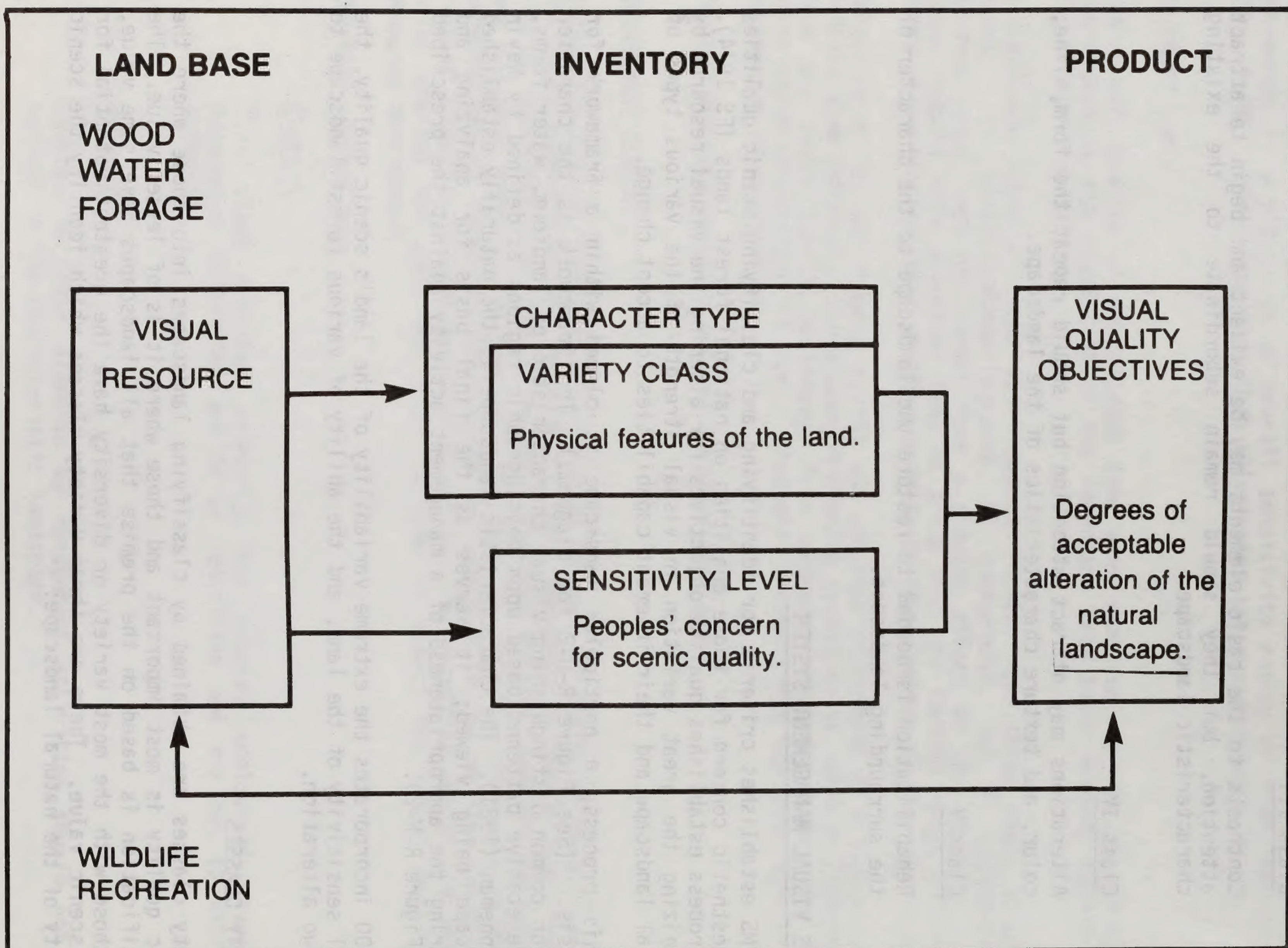

FIGURE R-H-2 THE VISUAL MANAGEMENT SYSTEM PROCESS

Class A, Distinctive

Areas where features of landform, vegetative patterns, water forms, and rock formations are of unusual or outstanding visual quality. They are usually not common in the character type.

Class B, Common

Areas where features contain variety in form, line, color, and texture or combinations thereof, but which tend to be common throughout the character type and are not outstanding in visual quality.

Class C, Minimal

Areas where features have little change in form, line, color, or texture. Includes all areas not included in Classes A and B.

SENSITIVITY LEVELS

Sensitivity levels are a measure of people's concern for the scenic quality of the national forests. These levels are determined for land areas viewed by those who are traveling through the forest on developed roads and trails, are using areas such as campgrounds and visitor centers, or are recreating at lakes, streams, and other water bodies. All national forest land is seen at least by aircraft users; therefore, some degree of visitor sensitivity exists for the entire land base.

Three sensitivity levels, each identifying a different level of user concern for the visual environment, are employed:

Level 1, Highest Sensitivity

Includes all areas seen from PRIMARY travel routes, use areas, and water bodies where, at a minimum, at least one fourth of the forest visitors have a MAJOR concern for the scenic qualities. Also includes all areas seen from SECONDARY travel routes, use areas, and water bodies where at least three-fourths of the forest visitors have a MAJOR concern for the scenic qualities.

Level 2, Average Sensitivity

Includes all areas seen from PRIMARY travel routes, use are and water bodies where fewer than one-fourth of the forest visitors have a MAJOR concern for scenic qualities. Also includes all areas seen from SECONDARY travel routes, use areas, and water bodies where at

least one-fourth and not more than three-fourths of the forest visitors have a MAJOR concern for scenic qualities.

Level 3, Lowest Sensitivity

Includes all areas seen from SECONDARY travel routes, use areas, and water bodies where less than one-fourth of the forest visitors have a MAJOR concern for scenic qualities and all national forest land not seen from any travel route, use area, or water body. It does not include any area seen from PRIMARY routes or areas.

Sensitivity levels are correlated with distance zones of foreground, middleground, and background for seen areas established in the sensitivity level determination. This step correctly emphasizes the viewers' concern for scenic quality within the system.

VISUAL QUALITY OBJECTIVES

The VQO's are designed to develop measurable standards or objectives for the visual management of all national forest lands. The objectives are based upon the previously determined variety classes and sensitivity levels. They are represented by five terms which can be defined as visual resource management goals.

Preservation (P)

Preservation allows for ecological changes only. Management activities, except for very low visual impact recreation facilities, are prohibited.

Retention (R)

Activities may only repeat form, line, color, and texture which are frequently found in the characteristic landscape.

Partial Retention (PR)

Management activities must remain visually subordinate to the characteristic landscape. Activities may repeat or introduce form, line, color or texture common to the characteristic landscape, but changes in their size, amount, intensity, direction, pattern, etc., must remain visually subordinate to the characteristic landscape.

Modification (M)

Modification activities may visually dominate the original characteristic landscape. However, vegetation and landform alteration must borrow from naturally established form, line, color, or texture so completely and at such a scale that the visual characteristics are those of natural occurrences within the surrounding area or character type. Additional elements must remain visually subordinate to the proposed composition.

Maximum Modification (MM)

Vegetation and landform alterations may dominate the characteristic landscape. However, when viewed as background, the visual characteristics must be those of natural occurrences within the surrounding area or character type. When viewed as foreground or middleground, they may not appear to borrow completely from naturally established form, line, color, or texture.

Unacceptable Modification (UM)

Management activities demonstrate excessive modification in the landscape regardless of the distance from which the management activity is observed. Usually the size of the activity is not to scale or is so excessive as to contrast with the characteristic landscape.

THE BLM VISUAL RESOURCE CONTRAST RATING SYSTEM

The objective of the visual resource contrast rating system is to provide a measure of whether the proposed action will meet the requirements of the assigned VRM classes (FS 1974, BLM 1978 and 1980). The degree to which a management activity adversely affects the visual quality of a landscape depends on the extent of visual contrast that is created between the activity and the existing landscape character. Contrast is measured by separating the landscape into land and water surfaces, vegetation, and structures and then predicting the magnitude, and structures and then predicting the magnitude of contrast with the basic elements (form, line, color, and texture) for each of these major features. Assessing the degree of contrast will indicate the severity of impact and will guide the plans for mitigating the contrasts to meet the requirements of the VRM classes. Contrasts are considered from the most critical viewpoints for distance, angle of observation, length of time, relative size of the project, season of the year, light, and the effects of time on the healing process.

The following parameters have been applied to determine if the proposed action will meet the requirements of the assigned VRM classes.

Class I: The degree of contrast for any one element may not exceed a weak degree of contrast (1x), and the total contrast rating for any one feature may not exceed 10.

Class II: The degree of contrast for any one element may not exceed a moderate value (2x), and the total contrast rating for any feature may not exceed 12.

Class III: The degree of contrast for any one element should not exceed a moderate value (2x), and the total contrast rating for any feature may not exceed 16.

Class IV: The total contrast rating for any feature should not exceed 20.

DURATION OF VISUAL IMPACT

Preservation (P)

Only ecological change is permitted.

Retention (R)

Immediate reduction in form, line, color, and texture contrast should be accomplished during or immmediately after construction.

Partial Retention (PR)

Reduction in form, line, color, and texture contrast should be accomplished as soon after project completion as possible or, at a minimum, within the first year.

Modification (M)

Reduction in form, line, color, and texture contrast should be accomplished in the first year or, at a minimun, should meet existing regional guidelines.

Maximum Modification (MM)

Reduction of contrast should be accomplished within 5 years.

DEGREE OF CONTRAST

For purposes of this project, the contrasts for each VQO should not exceed the parameters established for the following comparable VRM Classes:

FS VQO's	BLM VRM CLASSES
Preservation (P)	Class I
Retention (R)	Class II
Partial Retention (PR)	Class III
Modification (M) and Maximum Modification (MM)	Class IV
Unacceptable Modification (UM)	Class V

Specific contrasts in form, line, color, and texture indicate problems that could require design mitigation. Applying design procedures to the proposed action could eliminate or reduce visual contrasts to meet the visual planning objectives stipulated in the VRM class designations. If this were done, the project would be reassessed to determine if it could meet the area's visual goals and if not, to what degree the landscape's visual resource would be affected.

REFERENCES CITED

Bureau of Land Mangement. 1978. Manual Series 8400: Visual Resource Management. Washington, D.C.: Government Printing Office.

Bureau of Land Management. 1980. Visual resource management program. Washington, D.C.: Government Printing Office.

U.S. Department of Agriculture, Forest Service. 1974. Visual Management System. Agriculture handbook No. 462. Washington, D.C.: Government Printing Office.

UNCOMMITTED MITIGATION MEASURES

The following mitigation measures were identified during the process of impact analysis to further alleviate or minimize potential environmental effects from the proposed developments. However, these measures are not committed to by the federal agencies or the applicants. These additional mitigation measures are presented as additional information and for use by the applicants as voluntary implementation or by authorizing officials in eventual permit stipulation. These uncommitted mitigation measures are presented below by resource topic.

SOCIOECONOMICS

1. Single family, trailer sites, and mobile homes could be provided for sale or lease to employees at an affordable costs in order to mitigate expected housing shortage.

2. The sale of housing units that would be constructed by local developers could be formally guaranteed in order to provide an incentive for increased housing.

3. Rental commitments of units that would be constructed by local developers also could be formally guaranteed in order to provide an increased supply of housing.

4. Funds for local planning positions could be provided in order to allow careful planning and mitigation of community impacts.

5. Funding for certain service positions such as policemen or social workers could be provided in order to encourage an adequate supply.

6. Low interest loans with delayed payments could be provided until revenues increase. This would eliminate the problem of lag time between when community expenditures are needed and when the increased revenues begin.

7. Establish a housing office to help place workers in available housing units.

8. For the proposed synfuels projects the federal government could support synfuel legislation to provide direct special impact assistance to the Ute Indian Tribe.

9. The proposed synfuels projects could create a planning and assistance mechanism for the Ute Indian Tribe that closely parallels the proposed community impact assistance program for the state and local government.

10. A special referral assistance program could be established which would consist of those federal agencies who are presently responding to the Ute Indian Tribe's infrastructure impacts.

11. The proposed synfuels projects establish procedures that could include creation of a job training program. The training programs for the Ute Indian Tribe would be implemented by divert aid to local educational institutions or to a Native American organization. Such aid would be used to support relevant vocational skills training, and 2) adoption of an affirmative action hiring plan.

WATER RESOURCES

1. During periods of drought, pumping water from the White River could be suspended by the applicants. This measure would maintain minimum flows in the White River during droughts. This measure also matches trends in the White River Dam EIS, Appendix 3, Minimum Flow Releases (BLM 1982b).

2. A cooperative desalting program between the applicants could be implemented. By treating water in various portions of the Colorado River Basin, the applicants could offset salinity increases due to consumptively using relatively high quality water. Depending on the program, it could reduce the salinity at various measuring points.

VEGETATION, SOILS, AND RECLAMATION

1. Due to the need of implementation and compliance with an intensive erosion control and reclamation program to ensure successful erosion control and reclamation, an on site reclamation specialist could be employed by the applicants to provide: (1) liaison with private land owners, federal agency officals and local governments; (2) expertise to direct proper implementation of applicable restoration procedures and assure compliance; and (3) favorable public relations. This mesure would: (1) help ensure proper implementation and compliance with applicable and effective erosion control, reclamation and revegetation measures, and (2) provide expertise on site during construction to direct applicable reclamation procedures when special conditions are encountered without causing construction and operation delays.

WILDLIFE

Certain wildlife species would be adversely affected if pipeline construction took place in their habitats during critical periods in their life cycles. The proposed construction schedule would avoid many of these critical periods, therefore, adverse impacts are not expected. Other critical periods for wildlife coincide with the construction schedule. All identified critical habitats and use periods are listed in Tables R-I-1 and R-I-2.

1. Realignment of the pipeline could eliminate some adverse impacts, but could also add other critical areas to the list. The critical wildlife habitats and periods listed in Table R-I-1, could be avoided during construction, unless otherwise authorized.

TABLE R-I-1

CRUCIAL WILDLIFE USE AREAS AND PERIODS TO BE AVOIDED ALONG THE SALT LAKE CITY ALTERNATIVE PRODUCT PIPELINE

Nearest Mileposts	Dates When Construction Should be Avoided	Reason
White River Crossing (6.7)	March 15 thru July 15	Waterfowl nesting
10 - 17	May 10 thru June 20	Antelope fawning
18 - 22	March 15 thru July 15	Waterfowl nesting (National Wildlife Refuge)
25 - 27	March 15 thru July 15	Raptors-waterfowl nests
47 - 51	March 15 thru July 15	Waterfowl area
94 - 103	May 16 to July 1	Elk and deer fawning/calving
121 - 125	March 15 to July 15	Raptor habitat
140 - 142	May 16 to July	Deer fawning
139 - 157	October 31 to April 30	Big game winter range

TABLE R-I-2

STREAM AND RIVER CROSSINGS AND SUGGESTED CONSTRUCTION PERIODS

Nearest Milepost	Dates When Construction Should Occur	Reason
WHITE RIVER 6.7	August 15 to October 15	Lowest flows - Coordinate with release schedules
Green River 21	August 15 to October 15	Lowest flows - Coordinate with release schedules
Duchesne River 49	August 1 to October 15	Low flows - Coordinate with Bureau of Reclamation
Rock Creek 68	August 1 to October 1	Low flows - Indian lands Brown trout fishery
Duchesne River 71	Late fall and winter	Low water; no flow controls
Duchesne River 74	February	Low water; no flow controls
Duchesne River 87	August 15 to October 1	Private land
Duchesne River 90	August 15 to October 1	Low water - Late fall
West Fork Duchesne River 91 - 93	August 1 to October 1	Multiple Crossings - Low water - Fall construction
Spring Creek 92	August 1 to October 1	Low water
Wolf Creek 94	August 1 to October 1	Low water
Wolf Creek 100	August 1 to October 1	Low water
South Fork Provo River 105 and 107	July 15 to September 15	Reproduction area
Provo River 110, 111, and 115	July 15 to September 15	Rearing water

TABLE R-I-2 (Concluded)

STREAM AND RIVER CROSSINGS AND SUGGESTED CONSTRUCTION PERIODS

Nearest Milepost	Dates When Construction Should Occur	Reason
Silver Creek 134	July 15 to September 15	- - - -
Kimball Creek 132	July 15 to September 15	- - - -
Mountain Dell Creek 143	August 15 to October 1	Brown trout
Emigration Creek 144 and 148	July 15 to September 15	Cutthroat - Private
Red Butte Creek 150	July 15 to October 1	Brown trout
City Creek 154	August 15 to October 1	Brown trout

2. There are at least 20 stream or river crossings along the proposed pipeline route. Critical crossing times and milepost locations are listed in Table R-I-2. To reduce the likelihood of impacts to aquatic species, construction could be restricted to the periods identified.

3. In order to reduce harassement to wildlife, particularly big game animals on their winter ranges, all pipeline construction roads could be decomissioned to eliminate public access. If access roads are necessary for operation and maintenance, they must be approved by the authorized officer and clearly marked "No Access Except Authorized Vehicles." In high-use areas, the contractor may be directed to install and maintain gates to limit access.

4. Camping or parking could be prohibited at or near any livestock watering source, artificial water source, or spring, so that use by wildlife and domestic livestock would not be hampered. The restricted area should be determined by the authorized officer.

5. At stream crossings, care could be taken to create a minimum disturbance to vegetation in this important wildlife habitat type. In addition, all larger line trees and dead snags could be left standing, wherever possible, to benefit raptors and other species that require these types of trees. All management practices as defined in Title 33 CFR, 1980, ed., part 323 could be followed to lessen impacts to stream crossings.

AGRICULTURE

1. All road rights-of-way could be fenced to exclude animals. This measure would reduce or prevent losses of livestock due to collisions with construction traffic.

2. New water sources could be developed in areas presently not utilized for grazing due to lack of water. This measure would mitigate losses of forage and grazing areas due to project activities by opening up other areas for grazing.

TRANSPORTATION

1. Truck and heavy equipment traffic routes could avoid residential areas to reduce safety hazards and noise disturbance.

2. Nighttime truck and heavy equipment traffic could be avoided in municipal areas to eliminate nighttime noise disturbance.

3. To reduce traffic volume impacts, an alternative transportation system, including carpools, vanpools, buspools, or public transit system, could be established.

RECREATION

1. For purposes of minimizing boredom, the potential for deviant behavior, minimizing poaching and wanton killing of wildlife, and generally reducing the turnover rate, the on-site ocnstruction camp could include the following recreational facilities and activities: baseketball, racketball, pool, table tennis, weight training room, and locker and shower facilities.

2. Due to the predicted population growth caused by synfuels development for the low-level and high-level regional scenarios, new developed camping facilities would be needed to meet the anticipated public demand. Federal, state, county, local, private, and the Ute Indian Tribe could provide diverse camping opportunities.

3. Due to the predicted population growth in Vernal and Roosevelt, Utah, the new town at Westwater, Utah, and Rangely, Colorado, new municipal recreation facilities and local park areas would be needed to meet the leisure time needs of an expanding urban population. For example, Roosevelt would need a new year-round swimming pool and recreation community center (Eschler 1982); Vernal would need an additional recretaion community center, additional tennis, baseketball, and racketball courts; Rangely would need additional park acreage and day use areas (Bartlett 1982); and the new town of Westwater (predicted to have a population of 12,000 to 15,000 by 1995) would need all the local recreation facilities and park acreage to meet resident demands.

WILDERNESS

1. Due to a predicted increase in visitation to designated Wilderness Areas by the mid and late 1980's and early and mid 1990's within the region, federal land management agencies would likely have to institute a permit quota system to preserve naturalness and solitude wilderness resource characteristics for maintaining high quality user experiences and protection of resource values.

2. Due to the predicted increase in visitation to the Uintah and Ouray Indian Reservation by the public, more enforcement personnel would likely be needed to maintain wilderness-related values in the undeveloped Wilderness Areas of the Hill Creek Extension on reservation lands.

3. Due to the predicted incrase in visitation to the State roadless area in the P.R. Springs area, more enforcement personnel would likely be needed to maintain the natural characteristics, especially wildlife values, in this undeveloped area.

VISUAL RESOURCES

ROADS

1. Oil or water all non-land surfaced roads during the primary recreation season of May through September to keep visibility impacts from dust to a minimum.

2. Utilize existing raods as much as possible to maintain the existing quality of the visual resources and lessen other environmental impacts.

3. When constructing new roads or rebuilding existing roads, minimize the width of roads, keeping safety in mind, to lessen the imapct on the visual resource and other resoruce values.

4. Keep road cuts and fills to minimum when constructing new roads or upgrading existing areas to minimize the contrast in landform modification and contrast for the visual resource.

5. Double cut ends of culverts to match the road cut slopes, or use preformed end section, when installing culverts for roads in visually high or medium sensitive areas to reduce the visual contrast when adding a structure to the landscape.

6. Use self-weathering steel for guardrails in areas of high or medium visual sensitivity to reduce the visual contrast when adding such structures to the landscape.

TRANSMISSION LINES

1. Avoid locating transmission line towers so that they would "skyline" or silouette against the sky in areas of high or medium visual sensitivity so that increased contrasts in form and line would be reduced.

2. Use non-specular conductors, insulators, and towers in areas of visually high or medium sensitvie areas to reduce visual contasts created by reflection and added visibility of such structures which would be in contrast to the existing landscape.

3. Preplan transmission line corridors to lessen introduced visual contrasts of the structures with the existing visual landscape by screening or blending the transmission line characteristics where possible.

4. Minimize river and road crossings by transmission lines where possible in high or medium visually sensitive areas and where unavoidable cross at right angles with long span lengths to minimize the visual contrasts in form, line, and color of the added structures.

5. Avoid placing transmission line towerswhich would be in direct-ahead line of sight from high or medium sensitive travel routes or rivers to lessen the contrast of such added landscape structures.

6. Do not clear vegetation for transmission line construction unless the existing vegetation would directly interfere with construction or operation ofthe structures in high or medium visually sensitive areas. Lessened clearing would reduce the vegetative contrasts in form, line, color, and texture with the natural landscape.

7. Where possible, connect vegetative clearings for transmission line construction and operation with existing natural clearings, even if extra clearing would be reasonably necessary, to reduce the form, line, color, and texture or the contrast with the natural landscape vegetation.

8. When locating transmission lines through valley floors, align the structures along the break in landform or vegetation of the valley floor and sideslopes to reduce contrasts of the induced structures with the natural landscape features.

RIVER CROSSINGS

1. Bridges should be constructed of colored concrete, self-weathering steel, pressure-treated wood, or other materials which would blend with the surroundings to place as little impact on the visual resources in high and medium sensitivity areas.

2. Place pumps and other such equipment in underground vaults or where they would be screened by vegetation in areas of high or medium sensitivity where seen from the river to lessen visual contrasts.

3. Pipelines are to cross rivers at right angles where possible to be less in a person's line of vision from the river and lessen visual impacts as seen by the river user.

FACILITIES

1. Choose building materials, colors, and overall designs for facilities in high or medium visual sensitivity areas to closely help the facility blend with the surrounding landscape.

2. Locate facilities when possible to minimize visual contrast by taking advantage of landforms, vegetative pattern, etc.

3. Where feasible, remove and save topsoil for redistribution when constructing facilities so that the site may more easily revegetate when construction is complete.

4. Minimize vegetation removal when constructing facilities, or in a few cases, clear additional and vegetation to blend clearings with existing landscape conditions and help reduce visual contrast.

PRODUCT LINES

1. When constructing surface pipelines, colors of the pipeline should blend with the surrounding landscape where feasible, or as a minimum should be painted black, rather than galvanized or silver, to reduce visual contrasts.

2. Pipeline clearings should be natural in appearance, blending with natural vegetative cleraings and patterns, or where possible place pipeline along side existing roads, to minimize visual contrast with the natural landscape.

3. In areas where subsoil colors are different than surface soil colors and the visual sensitivity is high or medium, use proper traveling and backfill techniques to replace soils so color contrasts do not result in lessening the visual quality of an area.

MISCELLANEOUS

1. Where feasible, revegetate with indigenous plants, using on-site transplants, as an example, to help avoiding long-term visual contrasts with the natural landscape.

2. Plan uniformity in signing (highways, recreational, informational) to reduce visual contrasts by establishing harmony in signing.

PALEONTOLOGY

1. During excavation whenever fossils are encountered, the applicants should contact a qualified paleontologist. The qualified paleontologist should determine the value of the fossils and collect them and record their occurrence, if necessary. The relative value of paleontologic resources would be maintained and irretrievable losses of these resources minimized.

HEALTH AND SAFETY

1. Some of the oil shale's health and safety hazards can be reduced by:

   - the design and maintenance of safe working environments; and

   - health monitoring programs, including examinations and record keeping.

Initial training programs and refresher courses are required by Occupational Safety and Health Administration (OSHA) and Mine Safety and Health Administration (MSHA). These agencies also promulgate standards for working environments. Health inspections are sometimes included in OSHA/MSHA routine inspections, and special health inspections can be made if the agencies determine that a serious health hazard exists. At present, exchange of worker-health information among companies is not required, although some companies, especially in the coal mining industry, have organized such programs to provide data regarding occurrences of black lung among miners who change jobs within the industry.

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REVIEW AND EVALUATION OF APPLICANTS' EROSION CONTROL AND RECLAMATION PROGRAMS

Achieving successful reclamation and erosion control on lands disturbed by project development and operation in the Uintah Basin would require an intensive reclamation program. Important variables that strongly affect reclamation success in the region are: (1) severe climatic conditions (low, erratic precipitation and high winds); (2) soil properties, such as shallow depths, thin surface layers, low inherent fertility, moderate to strong salinity and alkalinity and the volumes of rock fragments; (3) strongly sloping to steeply sloping terrain; (4) preconstruction variations in vegetation types and their low densities; (5) livestock grazing control on newly seeded areas; and (6) off-road vehicle traffic control on access roads to minimize off-road land surface disturbance.

RECLAMATION SUCCESS AND RECLAMATION GOALS

The lack of successful reclamation in the past has been due, in part, to inadequate reclamation practices and/or a lack of compliance to applicable reclamation practices and continuing follow-up measures. Reclamation efforts have been improving in recent years due to: (1) stronger emphasis on achieving successful reclamation to meet regulatory requirements and a more dedicated stewardship commitment; (2) improved methods, procedures, and plant varieties; (3) improved kinds of machinery to implement practices; and (4) stronger emphasis on compliance and monitoring programs.

TYPES OF LAND DISTURBANCE

Different kinds of land disturbance caused by project activities would require tailored reclamation programs. These include: (1) reclamation and revegetation of land disturbed by surface facilities and installation of right-of-way facilities, such as pipelines, roads, and electric transmission lines; (2) reclamation and revegetation of spent shale disposal areas; (3) reclamation and revegetation of surface mined areas, and land disturbance caused by "in-situ" retorting process; and (4) protection and reclaimation of right-of-way areas subject to periodic construction disturbances due to common corridor use. Table R-J-1 identifies the types of land disturbance that would be caused by each applicants' project.

ASSUMPTIONS

The determinations made concerning erosion control and reclamation success on lands disturbed by project construction and operation activities are based on the following assumptions:

(1) Applicants operating on Utah State land would prepare and follow appropriate plans, including applicable measures and procedures,

TABLE R-J-1

TYPES OF LAND DISTURBANCE BY PROJECT

Project	Right-of-way Facility Construction	Spent Shale Disposal	Surface Mining	In-situ Retorting Process
Enercor (Rainbow)	X		X	
Enercor-Mono (P.R. Springs)	X		X	
Geokinetics	X	X	X	X
Magic Circle	X	X		
Paraho	X	X		
Sohio	X		X	
Syntana-Utah	X	X		
Tosco	X	X		

to accomplish and ensure successful reclamation of state land affected by project action, as required by the Utah State Department of Natural Resources, Division of Oil, Gas and Mining (State of Utah 1953). The erosion control and reclamation plans would fulfil requirements outlined by Form MR-1 (Revised May 1982) entitled "Notice of Intention to Commence Mining Operations and Mining and Reclamation Plan," (State of Utah 1982). This 12-page form outlines the preparation of a detailed reclamation plan, including: (1) maps identifying project location, drainage patterns, locations of stockpile and disposal areas; (2) maps identifying acreage to be disturbed by each project component; (3) geologic and overburden analysis; (4) construction and maintenance techniques for access roads; (5) dominant preconstruction vegetation; (6) vegetation removal methods; (7) soil types (surficial plant supportive material), overburden properties and revegetation potential; (8) method of removing and stockpiling soil material and overburden; (9) use of impoundments; (10 backfilling, grading, contouring and soil redistribution and stabilization techniques; (11) revegetation plan, including species, rate of seeding, season of planting, seedbed techniques, mulching, fertilizing and irrigation; (12) reclamation schedule, and (13) monitoring and follow-up program.

Performance and compliance of the applicant as required by the State of Utah Land Reclamation Act would be examined by members of the Utah State Division Staff (State of Utah 1953).

(2) Applicants would comply with the proposed erosion control and reclamation programs they have developed and/or would follow through on their commitment to "comply with appropriate regulations and required plans and stipulations to protect and restore the land disturbed by project construction and operation to a stable, productive and aesthetically acceptable condition."

The applicants' proposed erosion control and reclamation programs have been reviewed, evaluated and a determination made as to their adequacy, effectiveness and additional mitigation identified if necessary (refer to Specific Project Applicants Reclamation Program Evaluations section of this appendix).

(3) Results of special studies and field trials accurately assessed local conditions and potential for reclamation success. (Several applicants have conducted detailed soil and vegetation inventories and special on-site field studies to provide for adequate resource inventories, to identify revegetation and reclamation potential, to determine applicable reclamation measures and their effectiveness, and to identify source areas for favorable soil materials.)

(4) The following "Erosion Control, Revegetation, and Restoration Guidelines for use on Federal Lands" would be included as stipulations in the right-of-way grants issued to the applicants by the Bureau of Land Management and U.S. Forest Service, and would also be implemented for all other lands including state lands, Indian-owned and controlled lands, and private lands, as agreed on by the applicant and landowner.

EROSION CONTROL, REVEGETATION, AND RESTORATION GUIDELINES FOR USE ON FEDERAL LANDS

The following guidelines would be included as stipulations in the right-of-way grants issued to the applicants.

Standard procedures for the applicants would include implementation of erosion control and revegetation measures to assure that lands disturbed by construction and operation activities would be restored to a stable, productive, and aesthetically acceptable condition.

A detailed, site-specific reclamation plan would be developed and become part of the Operating Plan. Because the proposed rights-of-way are composed of many types of terrain, soils, vegetation, land uses, and climatic conditions, the detailed plan would include sets of techniques and measures tailored to each condition encountered. Local expertise and locally effective reclamation methods would be followed when the site-specific procedures for the detailed reclamation plan are developed. The erosion control, revegetation, and restoration guidelines and Operating Plan would be implemented under the direction of the appropriate agency official.

Detailed information regarding applicable techniques and technical assistance to private landowners concerning erosion control measures and reclamation procedures would be obtained from the Soil Conservation Service through local Soil Conservation Districts. Technical assistance and approval of written plans for federal lands would be obtained from the Bureau of Land Management and the U.S. Forest Service prior to any construction.

During construction of the applicants' projects, an on-site reclamation specialist would be employed by the applicants to provide: (1) liaison with private landowners, federal agency officials, and local governments; (2) expertise to direct applicable restoration procedures when special conditions are encountered, without causing construction delays; and (3) favorable public relations.

General erosion control and restoration measures have been developed for the following areas and will be included as part of the Operating Plan:

- Right-of-way and Site Clearing
- Trenching and Preservation of Topsoil
- Backfilling and Grading
- Land Preparation and Cultivation
- Revegetation

- Maintenance and Monitoring
- Use of Biochemicals

Right-of-way and Site Clearing

Emphasis would be placed on protecting existing vegetation and minimizing disturbance of the existing environment.

- Land grading would be done only on the area required for construction.

- Sidehill cuts would be kept to a minimum to ensure resource protection and a safe and stable plane for efficient equipment use. The authorizing agency would provide assistance and would approve sidehill cuts prior to construction.

- Existing ground cover such as grasses, leaves, roots, brush, and trees trimmings would be cleared and piled only to the extent necessary. Slash would be piled and later shredded and chipped for use in restoration operations or disposed of at the discretion of the authorized agency official.

- Trees and shrubs on the right-of-way that are not cleared would be protected from damage during construction.

- Where the right-of-way crosses streams and other water bodies, the banks would be stabilized to prevent erosion. Construction techniques would minimize damage to shorelines, recreational areas, and fish and wildlife habitat.

- Care would be taken to avoid oil spills and other types of pollution in all areas including streams and other water bodies and in their immediate drainage areas. All spills would be immediately cleaned up.

- Design and construction of all temporary roads would be based on an approved transportation plan and would ensure proper drainage, minimize soil erosion, and preserve topsoil. After abandonment, these roads would be closed and areas restored without undue delay or maintained at the discretion of the landowners. Restoration, including redistribution of topsoil, would be to the satisfaction of the landowner and/or regulatory officials.

- During adverse weather conditions, as determined by the on-site reclamation specialist, the authorizing agency would issue stop and start orders to prevent rutting or excessive tracking of soil and deterioration of vegetation in the right-of-way area.

- During construction activities near streams or lakes, sedimentation (detention) basins and/or straw bale filters would be constructed

to prevent suspended sediments from reaching downstream watercourses or lakes, as required by the authorizing officer.

- Actual construction activities would immediately follow clearing operations, especially in areas of soil that are highly susceptible to wind or water erosion and other special areas.

Trenching and Preservation of Topsoil

Trenching methods and techniques would ensure that:

- Topsoil is removed from the trench area by double-ditching (i.e., windrowed separately, protected, and replaced last during backfilling). This procedure would be followed as specified by the authorizing officer.

- Remaining unearthed materials are removed and stored in a manner that facilitates backfilling procedures, uses a minimum amount of right-of-way area, and protects the excavated material from vehicular and equipment traffic.

- Cofferdams or other diversionary techniques would be use where necessary to permit flow in one part of a stream while pipelaying construction occurs in another part.

- A specific trenching and excavated material stockpiling procedure would be used on steep-sloping and rough, broken terrain to ensure minimum disturbance as outlined in the Operating Plan. This procedure would be developed by both the authorizing officer and applicant.

Backfilling and Grading

The following backfilling and grading techniques would be used:

- Backfill would be replaced in a sequence and density similar to the preconstruction soil condition.

- Backfilling operations would be conducted in a manner that would minimize further disturbance of vegetation.

- The contour of the ground would be restored to permit normal surface drainage.

- In strongly sloping and steep terrain, erosion control structures such as water bars, diversion channels, and terraces would be constructed to divert water away from the pipeline trench and reduce soil erosion along the right-of-way and other adjoining areas disturbed during construction.

- All structures such as terraces, levees, underground drainage systems, irrigation pipelines and canals would be restored to preconstruction conditions so that they would function as orginally intended.

- The surface would be graded to conform to the existing surface of the adjoining areas except for a slight crown over the trench to compensate for natural subsidence. In cropland areas, especially border and furrow irrigated cropland, the soils would be compacted and the crown would be smoothed to match the bordering area to allow surface irrigation.

- Topsoil would be uniformly replaced over the trench fill and other disturbed areas to restore productivity to its preconstruction condition.

- Materials unsuitable for backfilling or excess backfill material would be disposed of as arranged by the authorizing officials.

- Temporary work space areas used at stream and highway crossings and other special sites would be restored to approximate preconstruction conditions and to the satisfaction of the authorizing officials.

- The right-of-way at stream crossings would be restored to a preconstruction state. The upland areas and banks would be revegetated to preconstruction conditions. Where this is not possible, they would be mulched with rock. The size of the rock mulch would be larger in diameter then materials excavated from the trench. The streambed would be returned to its original contours with sediments like those that were excavated.

<u>Land Preparation for Seeding and Cultivation</u>

Construction, backfilling and grading activities commonly cause compaction and alter soil conditions that affect soil productivity and/or seeding success in the right-of-way area. The following practices and techniques would be used to improve these soil conditions, protect soil from erosion and provide a favorable seedbed:

- In cropland areas, as required by the authorizing agency or landowner, subsoiling or chiseling would be used to ensure that soil compaction is reduced and preconstruction soil permeability is restored.

- Chiseling would be used, unless objected to by the landowner or authorizing agency, in range land areas to reduce compaction and improve soil permeability. Pitting and contour furrowing as directed by the authorizing agency or landowner would be done on steeper slopes of disturbed areas to increase infiltration and to reduce runoff and erosion.

- Suitable mulches and other soil stabilizing practices would be used on all regraded and topsoiled areas to protect unvegetated soil from wind and water erosion and to improve water absorption.

- Special mulching practices or matting would be necessary in critical areas where wind and water are serious erosion hazards to protect seeding, seedlings after germination, and plantings.

- Commercial fertilizers would be applied to soil areas with low inherent fertility to maintain crop yields and establish grass seedings. Application rates would be commensurate with annual precipitation and available irrigation water.

- Seedbeds for areas seeded to grass would be prepared to provide a firm and friable condition suitable for the establishment of grass stands.

- Rock mulches would be used in steep-sloping rock outcrop areas and low precipitation areas to reduce erosion and promote vegetal growth.

- Cultivation and land preparation operations on steeply sloping areas would be done on the contour to minimize erosion.

- Soil area with rock fragments, such as very coarse gravel, cobble, or stone scattered on the surface, would be restored to the original preconstruction surface condition to blend with the adjoining area, to avoid a smooth surface right-of-way area and to control accelerated erosion.

Revegetation (Reseeding and Planting)

The loss of vegetation from lands disturbed by pipeline construction can be mitigated only by satisfactory revegetation. To ensure a successful revegetation program, methods and procedures would be consistent with local climate and soil conditions and would follow recommendations and directions of local experts. Revegetation efforts would be continued until a satisfactory vegetative cover is established. The following practices and techniques would be used in areas where reseeding is suitable as determined by the authorizing agency:

- A firm seedbed would be prepared prior to seeding. This would include a mulch of plant residues or other suitable materials. A cover crop may be needed in larger disturbed areas.

- Seed would be planted by drilling, broadcasting or hydroseeding. Drilling is the preferred method because it is usually most successful. Drill seeding with a grass drill equipped with depth bands would be used where topography and soil conditions allow operation of equipment to meet the seeding requirements of the species being planted. Broadcast seeding would be used for

inaccessible or small areas. Seed would be covered by raking or harrowing. Hydroseeding would be done in critical areas determined by the reclamation specialist or authorizing officer.

- Only species adaptable to local soil and climatic conditions would be used. Generally, these would be native species. However, introduced species may be considered for specific conditions when approved by the landowner and regulatory authority. Seeding rates in critical area plantings and generally throughout the right-of-way would be increased 100 percent over regular seeding rates to allow for seed mortality due to adverse growing conditions.

- Seed testing would be conducted to meet state, federal, and agency seed requirements.
- Seeding would be done when seasonal or weather conditions are most favorable, and as determined by the landowner or authorizing officer.

- Grazing or mowing would be delayed at least one season after seeding to provide time for vegetation to become established, especially in highly erodible areas, unless objected to by the landowner or lessee. Protective fencing may be necessary in special areas and will be constructed, maintained, and removed according to authorizing agency specifications.

- In areas of low annual precipitation (generally less than 8 to 10 inches), where reseeding is not suitable or as successful, erosion control structures and measures would be applied on sloping areas to reduce accelerated erosion, to allow reestablishment of preconstruction surface soil conditions, and to allow natural revegetation.

- Trees and shrubs would be reestablished in areas as specified in the revegetation plan. Fifty temporary and/or permanent structures would be installed by the company at specific locations along the right-of-way and other disturbed sites to prevent off-road vehicle access.

Maintenance and Monitoring

Joint inspection of the right-of-way by the applicant and authorizing agency would be conducted to monitor the success and maintenance of erosion control measures and revegetation programs on native grazing land for two growing seasons, or for a period determined by the landowner on private land, or the authorized agency official on state or federal land. The monitoring program would identify problem areas and corrective measures to ensure vegetation cover and erosion control. Certification of successful revegetation and erosion control would be determined by the landowner or authorized agency official.

Use of Biochemicals

The use of biochemicals such as herbicides, fungicides, and fertilizers would comply with state and federal laws, regulations, and policies regarding the use of poisonous, hazardous, or persistent substances. State and federal wildlife agencies would be contacted if application of any of these substances would be on or near sensitive wildlife areas. Application of these substances would be by ground methods. Prior to the use of such substances on or near the permit or grant area, the applicant would obtain approval of a written plan for such use from the authorizing officer, landowner, and appropriate wildlife agency. The plan would outline the kind of chemical, method of application, purpose of application, and other information as required, and would be considered as the authorized procedure for all applications until revoked by the authorizing officer, landowner, or appropriate wildlife agency. This plan would become part of the Operating and Construction Plan.

Construction Timing

Pipeline construction activities on irrigated cropland would be timed, as possible, to avoid disruption of irrigation delivery systems during the major irrigation season, to reduce effects on crop production in areas of construction as well as adjoining irrigated cropland areas served by the systems.

REVIEW AND ASSESSMENT OF APPLICANTS' PROPOSED RECLAMATION PROGRAMS

The applicants' erosion control, reclamation, and revegetation procedures were reviewed using information collected for the vegetation, soils, agriculture and climatic review of the project. The reclamation procedures were evaluated in separate phases according to the type of land disturbance based on the potential problem areas and conditions identified in the vegetation, soils, and climatic inventories. The measures and procedures outlined by the applicants were then evaluated to determine whether they were applicable and effective for the range of soils, vegetation types, terrain, land use, and climatic conditions encountered in the project area.

Table R-J-2 is the checklist that was used as a guideline for the review and evaluation of erosion control, reclamation, and revegetation programs. The checklist is of a summarized list of effective and realiable measures and procedures essential for successful erosion control and reclamation. (The sources of these measures and procedures are identified on the table.) A summary of review comments for each applicant's proposed erosion control and reclamation program is presented in the following individual project discussions. Additional mitigation measures are also identified.

ENERCOR RAINBOW PROJECT

The erosion control and reclamation program outlined by Enercor identified the following (refer to Table R-J-1):

TABLE R-J-2

EROSION CONTROL, RECLAMATION AND REVEGETATION PROGRAM CHECKLIST FOR UBS SITE SPECIFIC PROJECT REVIEW AND ASSESSMENT-PARAHO PROJECT[1]

RECLAMATION METHODS AND PROCEDURES[2]	REVIEW COMMENTS REGARDING APPLICANT'S PROGRAM[3]

GENERAL MEASURES

A. Avoidance of Critical Areas by Preplanning Construction Alignment (Where Possible).

B. Construction Timing to Minimize Impacts (e.g., Cropland Areas).

C. Construction Precautions During Adverse Weather Conditions (e.g., Prevent Tracking and Compaction During Wet Soil Conditions).

D. Minimized Off-road Vehicle Travel to Reduce Land Surface Disturbance.

E. Preparation and Implementation of an Erosion Control, Reclamation and Revegetation Plan Tailored to Conditions, Within Project Area.

F. Reclamation Accomplished in all Disturbed Areas as soon as Practical.

G. Compliance with Regulations (Local, State and Federal) and Implementation of Applicable Measures and Procedure.

LAND SURFACE AREA DISTURBANCE, EROSION CONTROL AND RECLAMATION

A. Right-of-Way and Site Clearing and Preparation.

1. Minimize area disturbance
2. Vegetation and growth cover clearing, storage or disposal
3. Protection of existing vegetation
4. Protection of natural drainage
5. Land grading technique-steep slopes
6. Techniques used at stream crossings and streams
7. Erosion control (wind and water) measures
8. Sedimentation (retention) basins, dikes and diversions
9. Design, construction and restoration of temporary roads and construction sites.

B. Site Grading, Trenching and Preservation of Topsoil and Excavated Material Handling.

1. Topsoil (or suitable plant growth material) removal, storage and protection
2. Excavated material stockpiling procedures
3. Trenching techniques (steep sloping areas)
4. Grading techniques for surface facilities
5. Fill areas (compaction and erosion control)
6. Stream crossing techniques (trenching)

C. Backfilling, Shaping, and Cleanup.

1. Backfilling procedures (compaction)
2. Topsoil replacement
3. Restoring contour of land surface to permit drainage
4. Restoring soil physical conditions (subsoiling, etc.)
5. Restoring structures (roads, irrigation systems, etc.)
6. Match surrounding landscape (rock outcroppings, coarse fragments on surface, etc.)
7. Erosion control measures (contouring, terraces, diversions)
8. Excess or unsuitable excavated material disposal

D. Land Preparation for Seeding and Cultivation.

1. Measures to improve soil physical conditions
2. Seed bed preparation
3. Surface, roughness condition
4. Fertilizers and other soil admendments (if applicable)
5. Suitable mulches and mulching practices
6. Land preparation methods on "critical areas"

E. Revegetation (Reseeding and Planting).

1. Selection of adapted species
2. Seeding and planting methods and techniques
3. Supplemental irrigation (when applicable)
4. Protection of seedlings
5. Continuing revegetation efforts to ensure satisfactory cover (when necessary)

F. Maintenance and Monitoring.

1. Identifying maintenance, monitoring and corrective measures to ensure erosion control and successful revegetation

G. Use of Biochemicals.

1. Identify procedures regarding use of herbicides, pesticides, and fertilizers (when needed)

TABLE R-J-2 (Cont'd)

EROSION CONTROL, RECLAMATION AND REVEGETATION PROGRAM CHECKLIST FOR UBS SITE SPECIFIC PROJECT REVIEW AND ASSESSMENT-PARAHO PROJECT[1]

RECLAMATION METHODS AND PROCEDURES[2]	REVIEW COMMENTS REGARDING APPLICANT'S PROGRAM[3]
PROCESSED SHALE DISPOSAL AREA RECLAMATION	
A. Topsoil and Suitable Plant Growth Material Removal and Storage.	
B. Design of Disposal Area (Geomorphic Relationships, Blending with Surrounding Terrain).	
C. Ground Water Contamination Control.	
D. Suitable Surface Water Runoff Control Structures, and Retention Ponds (Surface Water Contamination Control).	
E. Placement and Compaction of Spent Shale.	
F. Shaping and Contouring Disposal Embankments.	
G. Leaching Soluble Salts from Root Zone.	
H. Topsoil or Suitable Plant Growth Material Replacement (Blending Color of Disposal Pile with Surrounding Area).	
I. Application of Organic Matter, Fertilizers and Soil Admendments.	
J. Erosion Control Measures (Contouring, Diversions, Benching, etc.).	
K. Seeded Preparation.	
L. Suitable Mulches and Mulching Practices.	
M. Selection of Adapted Species for Revegetation.	
N. Applicable Seeding and Planting Methods.	
O. Transplanting Native Shrubs and Trees to Blend Visually with Surrounding Area (If Applicable).	
P. Supplemental Irrigation (If Applicable).	
Q. Protection of New Seedlings and Plantings from Livestock and Wildlife.	
R. Continuing Revegetation Effects (Where Necessary).	
S. Maintenance, Monitoring and Corrective Measures.	
T. Use of Surface Water Runoff for Revegetation and Other Project Use.	
SURFACE MINING RECLAMATION	
A. Surface Mining Sequence and Design (Compatible with Terrain and Overburden).	
B. Overburden Analysis (Physical and Chemical).	
C. Topsoil and/or Suitable Plant Growth Material Removal and Storage.	
D. Materials Handling (Soils and Overburden).	
E. Ground Water Contamination Control Measures.	
F. Suitable Surface Water Runoff Control Structures and Retention Ponds (Surface Water Contamination Control).	
G. Covering Undesirable Spoil Material.	
H. Placement and Compaction of Spoil Material.	
I. Grading, Shaping and Restoration of Natural Surface Drainages.	
J. Topsoil and/or Suitable Plant Growth Material Replacement on Mine Overburden.	
K. Erosion Control Measures (Contouring, Diversion, Benching, etc.).	
L. Application of Organic Matter, Soil Admendments and Fertilizers.	

TABLE R-J-2 (Concluded)

EROSION CONTROL, RECLAMATION AND REVEGETATION PROGRAM CHECKLIST FOR UBS SITE SPECIFIC PROJECT REVIEW AND ASSESSMENT-PARAHO PROJECT[1]

RECLAMATION METHODS AND PROCEDURES[2]	REVIEW COMMENTS REGARDING APPLICANT'S PROGRAM[3]
M. Maintaining Soil Physical Conditions (Subsoiling etc.).	
N. Seed Bed Preparation.	
O. Suitable Mulches and Mulching Practices.	
P. Selection of Adapted Species for Revegetation.	
Q. Applicable Seeding and Planting Methods.	
R. Transplanting Native Shrubs (Nursurey Stock) to Blend Visually with Surrounding Area (If Applicable).	
S. Supplemental Irrigation (If Applicable).	
T. Protection of New Seedlings and Plantings from Livestock and Wildlife.	
W. Maintenance, Monitoring and Corrective Measures (Including Revegetation Efforts, Where Necessary).	
V. Use of Surface Water Runoff for Revegetation.	

[1]This checklist was developed by the Bureau of Land Management Division of EIS Services (EISS) to provide a guideline to review and evaluate the adequacy and effectiveness of applicant's proposed erosion control, reclamation and revegetation programs. The checklist consists of a summarized list of measures, practices and procedures essential to ensure successful reclamation, revegetation and erosion control for land disturbance.

[2]The measures and procedures listed have been used in meeting objectives associated with soil and water conservation, water management, pollution abatement, waste disposal, improved fish and wildlife habitat and improved quality of the environment. The effectiveness and reliability of these measures and procedures are based on research, field trials and experiences of many years. Specific measures associated with surface mining activities and processed shale disposal areas are based on recent research and field trials. All practices and procedures identified are well documented and have been demonstrated to be reliable in making assumptions regarding effectiveness when properly implemented. (References (30) available upon request from Bureau of Land Management, EISS, 555 Zang Street, Third Floor East, Denver, Colorado 80228.)

[3]Review comments should reflect the adequacy of the applicant's proposed program by: (1) identifying the essential measures and procedures recognized; (2) identifying essential measures omitted; (3) making note of overall intent and compliance to ensure successful reclamation, revegetation and erosion control; and (4) whether program is tailored to the needs and conditions (soils, vegetation and climate) of the project area. Additional migitation measures needed by applicant should also be identified.

General Measures:

The Enercor program very adequately recognizes items A through G. The reclamation efforts proposed will be directed toward returning the disturbed and mined lands to approved premining conditions. The program also states all reclamation efforts will be conducted in accordance with all regulations.

Land Surface Disturbance, Erosion Control and Reclamation:

The Enercor program very adequately identifies all the essential measures listed in Items A through G for rights-of-way facilities.

Item F: A monitoring and maintenance program has been identified. Certification of successful revegetation and erosion control would be based on compliance with agreement.

Item G: The program does not specifically identify procedure regarding the use of biochemicals. However, Enercor indicates compliance to all regulations, so it is assumed Item G will be adequately recognized.

Surface Mining Reclamation:

The Enercor program indicates all reclamation operations will be conducted in accordance with regulatory guidelines. The program identifies the essential measures listed in Items A through V. However, some of the items (Items H, K, L and T) are very generally recognized.

Item B needs additional detail concerning identification of physical and chemical properties of the overburden.

It is determined that: (1) Enercor's reclamation program identifies applicable measures and procedures to ensure successful restoration of land disturbance associated with construction of right-of-way facilities; (2) Enercor's program indicates compliance with regulatory guidelines for reclamation of surface mine areas. However, in order for Enercor to accomplish this compliance the following additional items (that will be part of the final plan as required by State of Utah) should be carried out: (1) conduct a detailed soil survey for the surface mine area to provide an inventory of soil types and terrain to identify areas most strongly susceptible an impacts, to identify revegetation and reclamation potential, to identify source areas for top soil and favorable plant growth material, and (2) provide a detailed overburden inventory and analysis to provide information necessary to reclaim the surface mine area.

MAGIC CIRCLE COTTONWOOD WASH PROJECT

The erosion control and reclamation program outined by Magic Circle (Magic Circle 1982) identifies the following (refer to Table R-J-1):

General Measures:

The Magic Circle program very adequately recognizes Items A through G. It identifies compliance with local, state and federal regulations and procedures.

Land Surface Disturbance, Erosion Control and Reclamation:

The Magic Circle program identifies the essential measures and procedures listed in Items A, B, C, D and E.

Item F: Program of erosion protection and revegetation will continue throughout the project until such time as the reclamation effort is deemed successful. Vegetation assessment and data collection will continue on site with the purpose of establishing reference areas that are in accordance with planned post-development land use.

Item G: Fertilizers will be used. If the use of other biochemicals is warranted, their use will be in accordance with applicable state and federal regulations.

Spent Shale Disposal Area Reclamation:

The Magic Circle program very adequately identifies all the essential measures and procedures listed in Items A through T. The program indicates the final reclamation plan will be validated in principle by results of studies, laboratory data, field trials, and current reclamation literature.

It is determined that: (1) The applicants' reclamation program identifies adequate, applicable measures and procedures to ensure successful restoration of land disturbance and reclamation of the spent shale disposal area and land disturbance caused by construction and operation of project right-of-way facilities.

In addition to the reclamation program outlined, Magic Circle has conducted the following: (1) a detailed soil survey that will be available later for the project area to provide an inventory of soil types and terrain to identify areas most susceptible to impacts caused by construction and operation activities, to identify revegetation and restoration potential, and to determine applicable reclamation measures; (2) a detailed vegetation survey to provide information concerning vegetation type, density, and revegetation potential.

The reclamation program outlined by Magic Circle, assuming intensive implementation, provides the necessary measures to ensure successful revegetation of all disturbed areas to a condition supporting the preconstruction (mainly sheep grazing and wildlife habitat). The reclamation program indicates the final plan will be based on applicable, proven measures and procedures, including specific techniques developed through recent and on-going field studies and research. The revegetation program is designed to minimize the

aesthetic impact of disturbed areas and provide a self-sustaining vegetative cover that will withstand the arid climatic and soil conditions typical of the area.

PARAHO-UTE PROJECT

The erosion control and reclamation program outlined by Paraho in their application (Paraho 1981a, Paraho 1981b, Paraho 1982) identifies the following (refer to Table R-J-1):

General Measures:

The Paraho program as outlined generally recognizes Items A through G. However, their program states, "The objective of the reclamation efforts will be to return the area to as near its original use and appearance as practical."

Land Surface Disturbance, Erosion Control and Reclamation:

The Paraho program is general and does not specifically recognize Items A through G. As stated above, only a general intent has been indicated.

The following statements are made: "Techniques used will emphasize the use of natural vegetation type and minimal use of supplemental irrigation water. Disturbed areas will be graded to approximate natural contours. Planting and seeding will be done in full. Site will be protected from grazing during the early growing seasons."

Spent Shale Disposal Area Reclamation:

The reclamation program outlined for establishing vegetative cover over the spent shale disposal area is very adequate. It is based on "Conceptual Design Criteria for a Retorted Shale Disposal Facility, Paraho Module, Phase I" (Woodward-Clyde 1980). The program development has involved the review of: (1) literature on retorted shale (especially Paraho properties as they relate to a plant growth medium; (2) Uintah Basin climate; and (3) results of research concerning establishment of vegetation on retorted shale.

The program also considers the availability and amount of suitable soil materials needed to cover the spent shale disposal area.

The reclamation program as outlined by Paraho presently will require additional measures for land surface disturbance associated with right-of-way facility construction. However, these additional measures are contained in the "Erosion Control, Reclamation, and Revegetation Guidelines for use federal Lands" and will be included as a part of the stipulation in the right-of-way grant; therefore, these measures will be required on federal lands.

The reclamation program outlined for the spent shale disposal area (Paraho 1982) is very adequate and is based on applicable measures and procedures including specific techniques developed through recent and on-going field studies and research.

It is determined that the applicant's reclamation program including the additional mitigation measures outlined would provide for a successful restoration of land disturbance.

In addition to the reclamation program outlined, Paraho has conducted the following:

(1) A detailed soil survey for the lease area to provide an inventory of soil types and terrain to identify areas most susceptible to impacts caused by construction and operation activities, to identify revegetation and restoration potential, to determine applicable reclamation measures, and to identify areas most suitable for sources of topsoil and favorable plant growth materials for use in covering the processed shale disposal areas.

(2) Demonstration plot studies and research consisting of processed shale reclamation, revegetation methods and types of plant material for the project area. Results from these continuing studies would aid in selecting effective reclamation methods, seeding methods, and adapted species (Paraho 1978).

SYNTANA-UTAH PROJECT

The erosion control and reclamation program outlined by Syntana-Utah in their technical report (Syntana-Utah 1982) identifies the following (refer to Table R-J-1):

General Measures:

The Syntana-Utah program adequately recognizes Items A through G. The program also emphasizes that in all cases the Syntana-Utah project will: (1) Be performed in such a manner as to minimize erosion and to ensure establishment of vegetation; and (2) meet permit requirements and stipulations as mandated in the regulatory process.

Land Surface Disturbance, Erosion Control and Reclamation:

The Syntana-Utah program identifies the essential measures and procedures listed in Items A, B, C, D and E.

Item F: Monitoring and maintenance will continue until reclamation success is determined to be adequate by agency personnel and landowners.

Item G: The use of biochemicals will comply with state and federal laws, regulations, or policies. The use of fertilizers is anticipated, other substances may be used only if the need arises.

Processed Shale Disposal Area Reclamation:

The Syntana-Utah program adequately recognizes the essential measure listed. Note the exception regarding Item H.

To ensure the success of reclamation efforts, methods will be consistent with the results of past and current research.

Item H: The spent shale should be covered with more than 6 inches of topsoil and/or suitable soil material. Recent studies indicate a thickness of 12 inches or more is needed to provide an effective medium for plant growth (refer to list of source for Table R-J-1).

In addition to the reclamation program outlined, Syntana-Utah is also conducting a detailed soil survey to provide an inventory of soil types and terrain to identify revegetation and reclamation potential and to determine applicable reclamation measures.

The reclamation program outlined by Syntana-Utah, assuming intensive implementation, provides the necessary measures to ensure successful revegetation of all disturbed areas to a condition supporting the preconstruction use consisting mainly of sheep grazing and wildlife habitat. The reclamation program is based on applicable and proven measures and procedures, including specific techniques developed through recent ongoing field studies and research.

TOSCO SAND WASH PROJECT

The erosion control and reclamation program outlined by Tosco in their project technical report (Tosco 1982) identifies the following (refer to Table R-J-1).

General Measures:

The Tosco program very adequately acknowledges Items A through G. Emphasis is placed on compliance with regulations (local, state, and federal) and with procedures outlined by landowner or authorized agency and state officials.

Land Surface Disturbance, Erosion Control and Reclamation:

The Tosco program identifies the essential measures and procedures listed in Items A, B, C, D, and E.

Item F: The monitoring and maintenance program is identified.

Item G: The program indicates that the use of biochemicals, where needed, would comply with local, state, and federal regulations and policies.

Spent Shale Disposal Area Reclamation:

The Tosco program incorporates all the essential measures listed. Tosco has conducted extensive field studies and research regarding processed shale reclamation and revegetation in the Colony and Sand Wash Project Areas. Their program is based on information gained from these studies. Selected references in the list of sources for Table R-J-1 identifies specific studies and their results.

In addition to the reclamation program outlined, Tosco has conducted the following:

(1) A detailed soil survey (Tosco 1981) for the project area to provide an inventory of soil types and terrain to identify areas most susceptible to impacts caused by construction and operation activities, to identify revegetation and restoration potential, to determine applicable reclamation measures, and to identify areas most suitable for sources of top soil and favorable plant growth materials for use in covering the processed shale disposal areas.

(2) Demonstration plant and research consisting of processed shale reclamation, revegetation methods, procedures and types of plant materials at the Sand Wash Site and Colony Site. Results from continuing studies will aid in selecting effective reclamation methods, seeding methods, and selection of adapted species (Tosco 1980, Cook 1974, Berg 1973, Merkel 1973, Harbert and Berg 1974).

The reclamation program as outlined by Tosco, assuming intensive implementation, provides the necessary measures to ensure successful revegetation of all disturbed areas to a condition supporting the preconstruction use (mainly sheep grazing and wildlife habitat). The reclamation program for the spent shale disposal area is based on applicable proven measures and techniques, including specific techniques developed through recent and on-going field studies and research.

ENERCOR-MONO POWER (P.R. SPRINGS PROJECT)

For this conceptual project, the applicant has proposed an adequate erosion control and reclamation program for disturbance caused by construction of right-of-way facilities, similar to the Enercor (Rainbow Project) program.

Since the major type of land disturbance associated with this project is surface mining, additional inventories concerning overburden analysis and more detailed soil surveys will be needed when the final reclamation plan is prepared.

It is assumed that an adequate erosion control and reclamation program will be implemented due to the compliance required by state and Federal agencies for their lands.

GEOKINETICS AGENCY DRAW AND LOFRECO PROJECTS

For these conceptual projects, the applicant has outlined an adequate and effective erosion control and reclamation program. Land disturbance associated with these projects will consist of surface disturbance caused for right-of-way facility installation, spent shale area disposal, underground blasting for a portion of the area where the in-situ retorting process will be used.

The applicant has also conducted on-site studies and field trials. The reclamation program is based on results and experience gained from these studies (Geokinetics 1981).

SOHIO ASPHALT RIDGE PROJECT

For this conceptual project, the applicant to date has presented a very general reclamation program, but has indicated that disturbed land would be reclaimed according to regulatory authority. It is assumed that an adequate reclamation program will be implemented because of the intent identified and because of the necessary compliance with the State of Utah Oil and Gas Conservation Act and with the erosion control and reclamation guidelines for federal lands.

SOIL EROSION AND EROSION CONTROL ANALYSIS

The Erosion Control, Revegetation, and Restoration Guidelines (refer to Assumption section of this Appendix) and the checklist (Table R-J-2) were developed and evaluated using information collected in the soils and vegetation review of the projects. The result of the evaluation was the determination that if the guidelines are followed and the appropriate monitoring occurs, the disturbed areas would be successfully revegetated upon completion of the construction phase of the projects. The methodology used to complete the evaluation is discussed below.

Soils, vegetation and climatic information was collected for the surface areas potentially disturbed by the proposed action and alternatives. Soil surveys were inventoried to identify soil types and terrain strongly affecting construction procedures, revegetation and restoration potential.

The soils data was analyzed and evaluated to identify the following:

- soil areas with soil properties that strongly affect restoration of cropland and revegetation of native rangeland.

- areas that are susceptible to high wind and water erosion hazards.

- effective measures to minimize the effect of soil disturbances caused by construction activities and control accelerated erosion.

- areas where erosion and resultant sediment yield affect water quality.

Soil erosion losses were estimated by the use of the universal soil loss equation (USLE) and the wind erosion equation as applied to construction sites for selected soil areas representing various conditions occurring throughout the proposed project areas.

Recent developments in the soil loss equation make it a potentially valuable tool for selecting and evaluating conservation practices on disturbed areas resulting from construction activities. The information gained by application of the USLE to selected soil sites was used as a basis for determining appropriate erosion control and revegetation measures and to evaluate the effectiveness of those measures to ensure successful erosion control, revegetation, and restoration.

Selected soils representing significant conditions in the project areas were analyzed. The soils and conditions presented in Table R-J-3 represent some of the conditions that would be expected to occur. The table also identifies the effectiveness of several erosion control measures or combinations that could be implemented to control soil loss.

Additional information, consisting of major rangeland management concerns and recommended conservation practices, was obtained from published detailed soil survey reports and the unpublished Uintah County Soil Survey.

The Erosion Control, Revegetation, and Restoration Guidelines and accompanying checklist were developed to cover the range of soil and vegetation types, terrain, land uses and climatic conditions by the procedures outlined above. A detailed site-specific construction and erosion control plan would be developed including locally recommended techniques and measures tailored to the conditions encountered. Proper implementation of the erosion control and revegetation measures outlined in the guidelines would assure successful restoration of land disturbed by project construction activities.

The outlined maintenance and monitoring program would identify problem areas caused by adverse weather conditions during restoration periods or small localized areas with adverse soil properties and provide corrective measures to ensure erosion control.

REVEGETATION

The five broad vegetation types in the Uintah Basin are a composite of several plant communities that occur within that particular climatic or physiograhic setting.

TABLE R-J-3

WATER EROSION RATES ASSOCIATED WITH SEVERAL SOIL EROSION TREATMENT AND REVEGETATION SCENERIOS

Soil Setting and Vegetation Condition	Condition, Erosion Treatment and Revegetation Scenario	Erosion Rates (Tons/Acres/Year)[a]
Walknolls Soil - (shallow, very channery, loamy Soils underlain by sandstone at 6 to 20 inches. Annual Precipitation - 5 to 8 inches. Slope - 15 percent, 150 feet long. Vegetation Cover - 15 percent.	Current Condition	3.6
	Exposed Soil[b]	12.6
	Erosion Control Measures:	
	- 100 feet interval water bars	10.0
	- 1 ton mulch	2.3
	- 1/2 ton mulch	4.4
Part of Map Unit UNE Walknolls - Gilston Association 2 to 25 percent slope.	- 100 feet interval water bars plus 1/2 ton mulch plus	3.5
	- 100 feet interval water bars plus 1/2 ton mulch plus contouring[c]	
	Reseeding (10 percent cover)[d]	
	- No Erosion Control Measures	5.7
	- 100 feet water bars	4.5
	- 100 feet water bars plus 1 ton mulch	3.5
	- 100 feet water bars plus 1 ton mulch plus contouring[c]	2.8
Motto Soil - Shallow, very flaggy, coarse loamy soils underlain by sandstone at 8 to 20 inches. Annual Preciptation - 5 to 8 inches. Slope - 8 percent, 300 feet long. Vegetation Cover - 15 percent.	Current Condition	1.9
	Exposed Soil[b]	6.5
	Erosion Control Measures:	
	- 200 feet interval water bars	5.0
	- 1 ton mulch	1.2
	- 1/2 ton mulch	2.3
Part of Map Unit - AOC Motto very flaggy loam, 2 to 8 percent slope.	- 200 feet water bars plus 1/2 ton mulch	1.8
	- 200 feet water bars plus 1/2 ton mulch plus contouring[c]	1.1
	Reseeding (10 percent cover)[d]	
	- No Erosion Control Measures	2.9
	- 200 feet water bars	2.3
	- 200 feet water bars plus 1/2 ton mulch	1.8
	- 200 feet water bars plus 1/2 ton mulch plus contouring[c]	1.1
Castner Soil - Shallow very channergy, loamy soils over shale at depths of 6 to 20 inches. Annual Precipitation 14 to 16 inches. Slope 25 percent, 200 feet long. Vegetation Cover - 30 percent.	Current Condition	3.8
	Exposed Soil[b]	27.0
	Erosion Control Measures:	
	- 100 feet interval water bars	18.0
	- 60 feet interval water bars	13.5
	- 1 ton mulch	4.9
	- 1/2 ton mulch	9.5
	- 60 feet water bars plus 1/2 mulch	4.7
	- 60 feet water bars plus 1/2 mulch pluc contouring[c]	4.3
	Reseeding (10 percent cover)[d]	
	- No Erosion Control Measures	12.2
	- 100 feet water bars plus 1 ton mulch	8.1
	- 100 feet water bars plus 1 ton mulch plus contouring[c]	2.9
	- 60 feet water bars plus 1 ton mulch	2.4
	- 60 feet water bars plus 1 ton mulch plus contouring[c]	2.2
Lanver Soils - Moderately deep, loamy soils with 35 to 70 percent rock fragments on the surface with sandstone at depths of 20 to 40 inches. Annual Precipitation - 8 inches. Slop - 8 percent, 300 feet long. Vegetation Cover - 25 percent. (This Soil represents moderately deep soils associated with shallow units).	Current Condition	1.0
	Exposed Soil[b]	6.5
	Erosion Control Measures:	
	- 200 feet interval water bars	5.0
	- 1 ton mulch	1.2
	- 1/2 ton mulch	2.3
	- 200 feet water bars plus 1/2 ton mulch	0.9
	- 200 feet water bars plus 1/2 ton mulch plus contouring[c]	0.5
	Reseeding (10 percent cover)[d]	
Part of Map Units: APE2 Lanver - Buckan very channery sandy loams 2 to 25 percent slope.	- No Erosion Control Measures	2.6
	- 200 feet water bars	2.0
	- 200 feet water bars plus 1 ton mulch	0.9
	- 200 feet water bars plus 1 ton mulch plus contouring[c]	0.5

NOTE: Soil and Vegetation Condition Selection based on tentative soil information from the unpublished Soil Survey for Uintah County, Utah.

[a]Based on Universal Soil Loss Equation (USLE) calculations using factors outlined in "Preliminary Guidance for Mining Activities in the Interior Wester United States."

[b]Represents completely base soil in a loose condition during construction activities. Soil loss estimates are speculative for slopes exceeding 24 percent as these value are beyond the range of research dta. Soil losses are identified as "Worst Case" and would require extremely adverse weather and construction conditions.

[c]Topsoil spreading, tillage and surface roughness done on the contour.

[d]Based on the establishment of 10 percent vegetative cover.

The mixed-desert shrub type, located at lower elevations near the White River, is composed of salt-tolerant, drought-resistant plants. The plant densities are low, with various locations ranging from barren to 20 percent ground cover in this 4- to 6-inch precipitation zone.

Revegetation is difficult in this low precipitation range; however, with timing of seeding and the addition of a mulch, a grass and forb cover can be successfully established within 2 to 10 years. Without a mulch, direct seeding is not recommended. The area disturbed would be shaped, surface rock or debris replaced, and the area allowed to revegetate naturally. This process could require up to 10 years for understory growth and from 20 to 40 years for shrubs and woody species to achieve preconstruction size and dimensions.

The pinyon-juniper type, upland-brush grass, Bookcliffs, and riparian vegetation types occupy different climatic zones but are basically composed of three classes of vegetation--tree species, brush and shrub species, and grass and forb species. Tree species would reseed naturally, but planting seedlings would ensure a greater degree of success. A period of 20 years for willows and up to 300 years for Englemann spruce trees would be required to reach full dimensions. Brush and shrub species would reseed naturally, sprouting from roots, or could be container planted. Approximately 10 to 40 years would be required for full regrowth. Grass and forb species could be reseeded with successful establishment anticipated within 2 to 5 years following reseeding.

Revegetation can be achieved in the region utilizing various techniques. However, the time element will vary from 2 to 10 years for establishment of seedlings.

The degree of success would be determined by the application of techniques and the degree of compliance exercised by the authorizing agency or landowner.

SUMMARY

It is predicted that successful erosion control, reclamation, and revegetation generally would be achieved throughout the project areas provided the applicants implement effective measures and procedures tailored to the kind of land disturbance and to the conditions encountered. It is emphasized, however, that to ensure reclamation success, a strong compliance program accompanied by an effective monitoring and maintenance program is necessary to ensure that applicable measures are applied effectively, and that follow-up measures are carried out. The compliance program would be conducted by the authorizing agencies and landowners for their lands. However, it should be noted that impacts to soils and its potential to produce preconstruction vegetation would be significant if applicable erosion control measures are not implemented due to lack of compliance with approved plans and if adverse weather conditions, mainly heavy rainstorms, would occur during construction before any erosion control measures could be installed.

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APPENDIX R-K

ENDANGERED SPECIES ACT COMPLIANCE

The Endangered Species Act of 1973 requires, under Section 7, that any federal agency carrying out any action that might affect an endangered species must consult with the Fish and Wildlife Service concerning the effects of the project on threatened or endangered species.

The correspondence contained in this appendix is the BLM's request for a Section 7 listing of threatened or endangered species and the response from the Fish and Wildlife Service supplying the list.

1792(142)
UBS

SEP 2 3 1981

Memorandum

To: Area Manager, U.S. Fish & Wildlife Service, Endangered Species Section, Federal Bldg., Room 1311, 125 South State St., Salt Lake City, UT 84138

From: Team Manager, Special Projects Environmental Impact Team

Subject: Uintah Basin Synfuels Projects - Request for List of all Threatened, Endangered, and Proposed Species, both Plant and Animal

Our office is presently in the preliminary stages of preparing an environmental impact statement for the Uintah Basin Synfuels Projects. The bulk of the projects are located in Uintah County, Utah, with a few developments in Grand County, Utah (see attached map). The EIS effort will consist of five site-specific projects and a regional assessment.

The site-specific projects include: a tar sand recovery proposal by Enercor - Mono Power and oil shale development projects by Magic Circle, Paraho, Syntana-Utah, and Tosco. There will be two additional "conceptual" projects proposed by Geokinetics and Sohio Shale Oil that will be analyzed only in the regional assessment.

Included with this letter is a summary of all the projects noted above and a large-scale map of the regional area and the various project sites.

In accordance with this endeavor, we are officially requesting a Section 7 listing as noted below:

1. A list of all listed and proposed endangered or threatened species of any plant or animal within the regional boundary.

2. A list of all designated or proposed critical habitats within the regional boundary.

3. The name, address, and telephone number of any endangered species recovery team chairman of any species involved in the regional area.

We would appreciate any distribution maps, seasonal ranges, etc., to be included if you have them. Our preliminary examination of the area indicates that T&E species that might be encountered include, at least, black-footed ferret, bald eagle, humpback chub, Colorado River squawfish, bonytail chub and Uintah hookless cactus. Any questions should be referred to Jack Edwards, Project Leader, or Ray Boyd, Wildlife Biologist, at FTS-234-6737.

Thank you for your attention in this matter.

/s/ Charles R. Tulloss

Enclosure

cc: Thom Slater (w/o encl.)

United States Department of the Interior

FISH AND WILDLIFE SERVICE
AREA OFFICE COLORADO–UTAH
1311 FEDERAL BUILDING
125 SOUTH STATE STREET
SALT LAKE CITY, UTAH 84138

OCT 30 1981

RECEIVED

IN REPLY REFER TO:

23 October 1981

MEMORANDUM

TO: Team Manager
Special Projects Environmental Impact Team
Bureau of Land Management
Denver, Colorado

FROM: Acting Area Manager
Area 5
Fish and Wildlife Service
Salt Lake City, Utah

SUBJECT: Uintah Basin Synfuels Projects

We have reviewed your 23 September 1981 memorandum requesting a list of Federally listed and proposed plant and animal species in the potential impact area of Enercor-Mono Power, Magic Circle, Paraho, Syntana-Utah, Tosco, Geokinetics, and Sohio Shale Oil, tar sands and oil shale development projects in northeast Utah. The following are the Federally listed threatened and endangered species in the project area with the name of the recovery team chairman as you requested.

Species	Recovery Team Leader
1. black-footed ferret (Mustela nigripes)	Dr. Raymond L. Linder South Dakota Cooperative Wildlife Research Unit Department of Wildlife and Fisheries Sciences South Dakota State University Brookings, South Dakota 57006 [605] 688-6121
2. bald eagle (Haliaeetus leucocephalus)	Dr. James Grier North Dakota State University Fargo, North Dakota 58102 [201] 237-8444
3. American peregrine falcon (Falco peregrinus anatum)	Mr. Gerald Craig Colorado Division of Wildlife P. O. Box 2287 Fort Collins, Colorado 80522 [303] 482-6575

4. humpback chub (Gila cypha)
5. bonytail chub (Gila elegans)
6. Colorado squawfish (Ptychocheilus lucius)
7. Uinta Basin hookless cactus (Sclerocactus glaucus)

Vacant
Contact: John Gill
Endangered Species Office
U.S. Fish and Wildlife Service
Room 1311, Federal Building
125 South State Street
Salt Lake City, Utah 84138
[801] 524-4430

In addition to the above official Federally listed species we would bring to your attention the following species identified in the Federal Register of 15 December 1980. These plant species are candidates for official listing by the Fish and Wildlife Service. While they are not at present protected under the Endangered Species Act, they should be considered in environmental planning so as to avoid further degradation to their limited populations and possible extinction. These species include:

Glaucocarpum suffrutescens
Cryptantha barnebyi
Aquilegia barnebyi
Arabis sp. (underscribed species from the Gray Knolls)
Astragalus hamiltonii
Astragalus lutosus
Festuca dasyclada
Penstemon goodrichii
Penstemon grahamii
Penstemon sp. (underscribed species from the White River)
Thelypodiopsis argillaceae

The District Office of the Bureau of Land Management in Vernal, Utah has in its files much of the best information available on the distribution of these plant species. The Fish and Wildlife Service requests the opportunity to photo copy this information for our own records. Mr. Larry England of our Endangered Species Office is preparing listing packages for Glaucocarpum suffrutescens, Festuca dasyclada, and the White River Penstemon, he has also prepared a draft recovery plan for Sclerocactus glaucus. Dr. James Miller of our Regional Office in Denver is preparing a listing package for Cryptantha barnebyi.

Section 7(c) also requires the Federal agency proposing a major Federal action significantly affecting the quality of the human environment to conduct and submit to the FWS a biological assessment to determine the effects of the proposal on listed and proposed species. The biological assessment shall be completed within 180 days after the date on which initiated or a time mutually agreed upon between the agency and the FWS. Before any contracts for construction are entered into, and before construction is begun the assessment must be completed. If the biological assessment is not begun within 90 days, you should verify this list with us prior to initiation of your assessment. We do not feel that we can adequately assess the effects of the proposed action on listed and proposed species or critical habitat and proposed critical habitat without a complete assessment. When conducting a biological assessment, you shall, at a minimum:

1. conduct a scientifically sound on-site inspection of the area affected by the action, which must, unless otherwise directed by the FWS, include a detailed survey of the area to determine if listed or proposed species are present or occur seasonally and whether suitable habitat exists within the area for either expanding the existing population or potential reintroduction of populations;

2. interview recognized experts on the species at issue, including those within the Fish and Wildlife Service, the National Marine Fisheries Service, state conservation agencies, universities, and others who may have data not yet found in scientific literature;

3. review literature and other scientific data to determine the species' distribution, habitat needs, and other biological requirements;

4. review any other relevant information.

The FWS representative who will provide you with technical assistance is J. Larry England of our Endangered Species Team in Salt Lake City, Utah ([801] 524-4430; FTS 588-4430).

After your agency has completed and reviewed the assessment, it is your responsibility to determine if the proposed action "may affect" any of the listed species or critical habitats. You should also determine if the action is likely to jeopardize the continued existence of proposed species or result in the destruction or an adverse modification of any critical habitat proposed for such species. If the determination is "may affect" for listed species you must request in writing formal consultation from the Area Manager, U. S. Fish and Wildlife Service at the address given above. In addition, if you determine that the proposed action is likely to jeopardize the continued existence of proposed species or result in the destruction or adverse modification of proposed critical habitat, you must confer with the FWS. At this time you should provide this office a copy of the biological assessment and any other relevant information that assisted you in reaching your conclusion.

Your attention is also directed to Section 7(d) of the Endangered Species Act, as amended, which underscores the requirement that the Federal agency or the applicant shall not make any irreversible or irretrievable commitment of resources during the consultation period which, in effect, would deny the formulation or implementation of reasonable and prudent alternatives regarding their actions on any endangered or threatened species.

The FWS can only enter into formal Section 7 consultation with another Federal agency or its designee. State, county or any other governmental or private organizations can participate in the consultation process, help prepare information such as the biological assessment, participate in meetings, etc. We are prepared to assist you whenever you have questions which we may be able to answer. If we can be of further assistance, please advise us.

William C. White

United States Department of the Interior

FISH AND WILDLIFE SERVICE
AREA OFFICE COLORADO—UTAH
1311 FEDERAL BUILDING
125 SOUTH STATE STREET
SALT LAKE CITY, UTAH 84138

SPECIAL PROJECTS STAFF

DEC 29 1981

RECEIVED

IN REPLY REFER TO:

18 December 1981

MEMORANDUM

TO: Chief
Environmental Impact Statement Office
Bureau of Land Management
Denver, Colorado

FROM: Acting Area Manager
Area 5
Fish and Wildlife Service
Salt Lake City, Utah

SUBJECT: Uinta Basin Synfuels Project - Supplemental List

We have received your memorandum of 20 November 1981 concerning the Rangely, Colorado to Salt Lake City, Utah pipeline feature of the Uintah Basin Synfuels Project. Our 23 October 1981 response to your 23 September 1981 request of a list of threatened and endangered species in the vicinity of the project remains adequate. Threatened and endangered species in the area traversed by the proposed pipeline include the following:

black-footed ferret	Mustela nigripes
bald eagle	Haliaeetus leucocephalus
American peregrine falcon	Falco peregrinus anatum
humpback chub	Gila cypha
bonytail chub	Gila elegans
Colorado squawfish	Ptychocheilus lucius
Uinta Basin hookless cactus	Sclerocactus glaucus

If we can be of any further assistance, please advise us.

Robert D. Jacobsen

ENERGY EFFICIENCY

Energy efficiency is concerned with the energy cost of producing energy. It is defined as the net energy output divided by the net energy input times 100. Direct energy output consists of the useable energy contained in the output product(s). Direct energy input consists of the fuels consumed in producing the energy, both the fuel contained within the material being converted and that brought in from other sources to assist in the conversion process. The transportation of the raw materials to the processing plant and the transportation of the products and waste products away from the plant are part of direct energy inputs.

Indirect energy includes that energy needed to produce the fuels and equipment to do the job. Every material has an energy input associated with it. This includes all the incremental energies needed through all the steps from locating the ore to manufacturing the item needed, including shipping, handling, and supporting the employees doing the work. Any manufactured product contains one or many different materials, each contributing its incremental energy input.

Logically, a part of the direct energy associated with a project is that consumed in the infrastruture needed to support the project, in the energy used by the employees of the project, their families, and the secondary industries (including social services) supported by the employees and their families. Infrastructure is usually kept separate from other indirect energy.

A major difficulty in comparing energy efficiencies in the past has been in defining the boundaries within which the energy analyses have been performed. The conversion of energy from one form to another will result in a net loss of available energy. The losses can be samll; typically, an alternating current transformer will deliver more than 98 percent of the electricity coming to it. Losses can also be very large; it is not unusual for the energy delivered to the customer's electric meter to be as little as 15 percent of the energy contained in the coal in the ground, including the coal which is not recoverable due to mining the rest.

The same is true for oil production, natural gas, oil shales, tar sands, and other forms of fossil energy. Any energy conversion process results in a net loss of available energy; instead, it provides a larger amount of useable energy.

A more rigorous rationale is presented in Energy Analysis Handbook for Preparation of Oil Shale Development Environmental Impact Statements, (BLM 1982a) publication, in pre-publication form, was used as the primary source for energy conversion factors contained in the net energy analyses in this EIS.

INFRASTRUCTURE

Every new employee hired at a project uses energy to feed, clothe, house, and entertain himself, his wife, and his children. The increased numbers of families in a community add secondary employment in the community, as in additional school teachers, policemen, grocery clerks, appliance servicemen, and so on. The presence of a new project increases business for the community and may result in new service establishments. The growth of the infrastructure tends to lag behind the increase in employment, but new employment from the five major synfuels projects is expected eventually to result in 7.33 persons per employee. Because of the lag factor over 20 years, the net energy analysis is predicated on per-capita use of energy at a rate of 5.23 persons per new employee at the five projects. As shown on Table R-L-1, it is expected that the energy used directly and indirect energy sequestered in materials produced or imported for the primary and secondary employees and their families would average nearly 78 trillion Btu's per year over the 20 year period between 1981 and 2000.

TABLE R-L-1

INFRASTRUCTURE INDIRECT ENERGY CONSUMED BY PRIMARY AND SECONDARY EMPLOYMENT AND FAMILIES

Project	Employment	Population Increase	Petroleum (Btu/yr)	Natural Gas (Btu/yr)	Coal (Btu/yr)	Hydropower (Btu/yr)	Nuclear (Btu/yr)	Totals (Btu/yr)
Enercor	256	1,339	5.207 E11	2.562 E11	2.631 E11	1.667 E12	3.761 E10	2.745 E12
Magic Circle	1,741	9,105	3.541 E12	1.742 E12	1.789 E12	1.134 E13	2.558 E11	1.866 E13
Paraho	1,523	7,965	3.098 E12	1.524 E12	1.565 E12	9.916 E12	2.237 E11	1.633 E13
Syntana-Utah	1,631	8,529	3,317 E12	1.632 E12	1.676 E12	1.062 E13	2.396 E11	1.748 E13
Tosco	2,103	10,998	4.277 E12	2.104 E12	2.161 E12	1.369 E13	3.089 E11	2.254 E13
TOTAL	7,255	37,940	1.475 E13	7.257 E12	7.454 E12	4.723 E13	1.066 E12	7.776 E13

NOTE: Numbers are given to base 10, the digits after the "E" being the exponent.

Sources: Population - UPED model, (State of Utah 1982b).
Employment - Project figures.
Energy equivalents - BLM 1982a.

APPENDIX SS-A
GENERAL MEASURES FOR GRANTS AND PERMITS

As a condition of granting the various rights-of-ways and permits the various agencies would require that certain terms and conditions are met. Some of these general measures are presented in this appendix. As project plans are finalized and before specific authorizations are given, additional specific requirements would be added by the various authorizing agencies.

A Construction Operation (CO) plan or similar document would be prepared covering the construction of all project facilities on federal land. This plan would be submitted for approval by the authorizing agency prior to commencement of work on the ground. The CO plan would contain the following sections on site-specific stipulations: (Because the various rights-of-way would be composed of many types of terrain, soils, vegetation, land uses, and climatic conditions, the sections within the CO plan would include sets of techniques and measures tailored to each condition encountered).

- Fire Protection
- Clearing - Visual Resources
- Erosion Control, Revegetation, and Restoration. Specific guidelines for the Erosion Control, Revegetation, and Restoration Section of the CO plan are included in this report as Appendix R-J.
- Transportation
- Communications
- Cultural Resources
- Threatened and Endangered Studies and Mitigation (including a wildlife mitigation plan developed jointly by Utah Division of Wildlife Resources (UDWR), Bureau of Land Management (BLM), U.S. Forest Service (FS), and the applicant).
- Blasting
- Pesticide and Herbicide Use
- Health and Safety
  a. Solid Waste
  b. Emergency Response
  c. Air Quality
  d. Transportation
- Site Prescription
- Right-of-way Maintenance and Monitoring

Technical assistance and approval of written plans for Federal lands would be obtained from BLM and the FS prior to any construction.

Under authority of Section 504 of the Federal Land Policy and Management Act (FLPMA), the applicant would be required to provide funding to the appropriate federal agencies for the purpose of financing one or more specialists for administration of construction activities.

The Uintah and Ouray Tribe intends that all applicable federal and state measures, as well as those requirements of the Ute Indian Tribe and the Bureau of Indian Affairs, Uintah-Ouray Agency, will be applicable to authorizations that may be issued for Tribal land use.

General measures applicable to Tosco's Salt Lake City Alternative Pipeline that are site-specific and developed as a result of impact analysis, can be found in the Salt Lake City Alternative, Tosco's Oil Shale Product Pipeline Technical Report, Section 2 Part A, Mitigation Measures.

BUREAU OF LAND MANAGEMENT AND U.S. FOREST SERVICE

GENERAL

1. All state and federal regulations and laws will be complied with.

2. All activities associated with the projects will be conducted in a manner that will avoid or minimize degradation of air, land, and water quality. In the construction, operation, maintenance, and abandonment of the projects, activities will be performed in accordance with applicable air and water quality standards, and related plans of implementation, including but not limited to, the Clean Air Act, as amended (42 USC 1321) and the Clean Water Act (USCA 1251).

3. Permittees and other regular users of public lands affected by construction of the projects will be notified in advance of any construction activity that may affect their businesses or operations. This will include, but not be limited to, signing of temporary road closures, and notification of proposed removal and/or cutting of fences, and disturbances to range improvements or other use-related structures.

TRANSPORTATION

1. A transportation plan will be submitted as part of the CO plan. This plan will cover approval of temporary, reconstructed, and newly constructed roads and will include clearing work, signing, rehabilitation, and uses associated with transportation needs. Overland access could be specified in lieu of road construction or reconstruction.

2. Access roads necessary for operation and maintenance of the projects will be clearly identified. Some of these access roads may be designated by the authorizing agency as open for public use, including but not limited to, off-road vehicular (ORV) travel.

3. Helicopters would be used to string pipe and deliver equipment in areas where access to the terrain or management constraints preclude standard construction.

4. The rights-of-way will be used as an access road only when necessary and only during the construction period. The temporary access roads within the rights-of-way will be closed and vegetative cover reestablished after construction is completed. No maintenance roads along the pipelines will be permitted.

5. The applicants will control ORV use on the rights-of-way. Such specified control could include use of physical barriers, replanting trees, or other reasonable means of ORV control.

6. Gates or cattle guards on established roads on public land will not be locked or closed by the applicants.

LAND USE

1. Disturbance of improvements such as fences, roads, and watering facilities during the construction and maintenance of the rights-of-way must be kept to an absolute minimum. Immediate restoration to any damage of improvements to at least their former state will be required. Functional use of these improvements must be maintained at all times. When necessary to pass through a fence line, the fence shall be braced on both sides of the passageway prior to cutting of the fence. A gate acceptable to the authorizing agency official shall be installed in the gate opening and kept closed when not in actual use. Where a permanent road is to be constructed or maintained, cattleguards shall be placed at all fence crossings.

2. The right-of-way would coincide with the existing Chevron oil pipeline right-of-way, except where terrain conditions require additional width for both construction and permanent right-of-way needs. The authorized officer would establish right-of-way widths.

3. If a natural barrier used for livestock control is broken during construction, the applicants will adequately fence the area to prevent drift of livestock. In pronghorn ranges, the fence may have to be constructed to allow for animal passage. Fence specifications will be determined on a case-by-case basis.

WATER

1. All river, stream, and wash crossings required for access to project facilities would be at existing roads or bridges, except at locations designated by the authorizing agency official. Culverts or bridges, will be installed at points where new permanent access roads cross live streams to allow unobstructed fish passage. Where temporary roads cross drainages or dirt fills, culverts will be installed and removed upon completion of the project. Any construction activity in a perennial stream is prohibited unless specifically allowed by the authorizing agency official. All stream channels and washes will be returned to their natural state.

2. Construction plans for stream crossings by boring, driving, or trenching would be approved by the authorized officer.

3. A buffer strip of terrestrial vegetation above the high water line would be left between work areas adjacent to the stream and the stream itself.

4. In steams, construction would be planned to coincide with low water flows.

5. The applicant would complete the work and return the stream to its natural state as soon as possible.

6. Stream banks would be returned, as nearly as possible, to their original condition.

7. Backfill material for the pipe in the streambed would be of predominantly course material.

8. Construction equipment would be refueled and maintained outside of stream channels in areas designated by the authorizing agency official.

WASTE

1. Construction equipment must be refueled and maintained outside of stream channels in areas designated by the authorizing agency official.

2. Garbage and other refuge will be disposed in an authorized disposal site or landfill. Engine oil changed on federal lands will be contained in suitable containers and disposed as refuse; no fuel, oil, or other hydrocarbon spills are permitted. If such a spill accidentally occurs, the authorized officer would be notified immediately and corrective measures undertaken as directed.

3. Within 30 days after conclusion of construction and operation, all construction materials and related litter and debris shall be disposed in accordance with instruction of the authorized officer.

VEGETATION

1. Vegetation cleared during construction or other activity will be disposed of as directed.

2. Commerical tree species cut would be measured and paid for.

3. Disturbed areas, which in the opinion of the authorizing agency are unsuitable for successful revegetation, shall be protected under the reclamation, erosion control, and revegetation provisions of the CO plan. This plan shall state the method of protection to be used and the provisions for prevention of site deterioration and introdution of noxious weeds. At a minimum, the CO plan will include the reclamation, erosion control, and revegetation items described in Appendix R-J for all federal land rights-of-way.

4. Preclearing of mountain brush and tree-covered areas prior to dozer and maintenance blade work would be required. Preclearing will involve handwork in cutting of brush and trees and removal to designated areas.

SOILS

1. Existing soils and geological data will be gathered and used to achieve maximum revegetation and soil erosion mitigation responses.

2. Areas subject to mudflows, landslides, mudslides, avalanches, rock falls, and other types of mass movement will be avoided where practical in locating linear facilities. Where such avoidance is not practical, the design, based upon detailed field investigations and analysis, will provide measures to prevent the occurrence of mass movements.

3. All topsoil and suitable plant growth material on federal lands will be conserved for reclamation requirements; excess topsoil will be stockpiled at designated locations.

4. All disturbed areas shall be landscaped and revegetated as nearly as possible to their original condition or to a condition agreed upon by both the applicant and the authorizing agency official. This reclamation shall be accomplished as soon as possible after the disturbance occurs.

5. The reestablishment of vegetative cover and establishment of watershed stabilization measures will be completed during the ongoing working season and prior to the next winter season.

6. Trees and brush (indigenous species) will be established according to the revegetation, erosion control, and rehabilitation plan contained within the CO plan.

7. In areas where soil surface had been modified or natural vegetation had been removed, noxious weeds will be controlled.

8. Clearing in timber areas to reduce fire hazard will be limited to the right-of-way.

9. Stumps will not be higher than six (6) inches. The trees will be limbed and stacked adjacent to the right-of-way. Slash will be spread over the right-of-way during cleanup.

10. Fire control provisions will be included in the CO plan. The applicant shall do everything reasonably possible, both independently and upon request of the authorized officer, to prevent and suppress fires on or in the immediate vicinity of the right-of-way or permit area. This includes making available such construction and maintenance force as may be reasonably obtained for the suppression of fires.

VISUAL

1. A plan to minimize visual impacts from structures will be required as a part of the CO plan. The applicants will design and locate the pipeline routes and ancillary structures to blend into the existing environment so as to meet the minimum degree of contract acceptable for the Visual Resources Management class and Visual Quality Objectives in which the structures would be located. The authorizing agency will evaluate and approve measures before construction began.

2. Edges of right-of-way vegetative clearing would be feathered to avoid straight lines.

CULTURAL

1. All significant cultural resources identified on the project area will be avoided wherever possible. For significant cultural resources that cannot be avoided, a Memorandum of Agreement with the Advisory Council of Historic Preservation and the Utah State Historic Preservation Office will be developed that details specific mitigation measures in accordance with 36 CFR 800. All cultural resources discovered during construction that were not previously identified will be left undisturbed until they can be evaluated for significance.

PALEONTOLOGY

1. The applicant will provide a qualified paleontologist who is approved by the authorizing officer. The paleontologist will conduct an intensive survey of all areas to be disturbed according to the significance and mitigation needs specified by the applicant. The paleontologist will be available, as needed, during surface disturbance. If in the opinion of the paleontologist, paleontolgical values specified by the applicant would be disturbed, construction will be halted until appropriate action could be taken.

WILDLIFE

1. The applicants will be required to conduct surveys to determine if listed threatened or endangered species or their critical habitats may be present on areas to be disturbed. If it is determined that listed species or their habitats may be present and could be affected by the proposals, appropriate consultation with the U.S. Fish and Wildlife Service (FWS) will be conducted by the federal authorizing agency. No activities will be authorized until consultation is complete as specified by Section 7(c) of the Act. The Biological Opinion issued by FWS as a result of the consultation process will specify the specific mitigation measures to be carried out by the applicant.

2. Any active golden eagle nest found within 1-mile of project activities would have to be protected from harassment during the critical nesting period in accordance with provisions established by the Bald Eagle Protection Act.

PESTICIDES

1. Applicable federal and state laws and regulations concerning the use of pesticides (i.e. insecticides, herbicides, fungicides, rodenticides, and other similar substances) will be complied with in all activities and operations. The applicants will obtain program approval from the authorizing agency prior to the use of such substance. The program request will provide the type and quantity of material to be used; the pest, insect, fungus, etc., to be controlled; the method of application; the location of storage and disposals of containers; and other information that may be required. The request will be submitted no later than December 1 of the calendar year prior to the start of the fiscal year that the activities are proposed (i.e., December 1, 1982, deadline for a fiscal year 1983 action). Emergency use of pesticides will be approved by the authorizing agency. A pesticide will not be used if the Secretary of the Interior or Agriculture has prohibited its use. A pesticide will only be used in accordance with its registered uses and with other Secretarial limitations. Pesticides will not be permanently stored on federal lands.

U.S. FISH AND WILDLIFE SERVICE

For protection of the habitat of the Colorado squawfish, humpback chub, bony-tail chub, and razorback sucker, the applicant would be required to implement the following measures at the White and Green river pipeline crossings and Lower Duchesne River pipeline crossing south of U.S. Highway 40 for the Tosco Salt Lake City Alternative Product Pipeline:

1. Install automatic shut-off valves on the pipeline. Tosco's alternative product pipeline would be required to have a shut-off valve at the eastern edge of the Wyasket Basin (proposed for a floodplain) and on the western bank of the Green River.

2. Locate emergency oil spill cleanup equipment (booms and skimmers) adjacent to the river pipeline crossings.

3. Instream construction would be planned to coincide with low water flow with no construction permitted between August 1 and November 15.

4. No construction disturbance would be allowed in backwater areas.

5. Backfilling practices and reseeding with native grasses and native forbs would be required of all disturbed land on the Ouray National Wildlife Refuge.

UINTAH AND OURAY TRIBAL REQUIREMENTS

The Ute Indian Tribe is a local sovereign government with specific land use requirements. Final mitigation measures and stipulations would require approval of the Uintah and Ouray Agency, Bureau of Indian Affairs (BIA). Decisions of action would be made through the Ute Tribal Business Committee on a case-by-case basis.

The Ute Indian Tribe intends that these measures listed for lands and/or resources administered by federal agencies be applicable to authorizations they may issue for tribal land use.

The following are some of the provisions (general measures) that would be included in a Surface Use and Operating Plan for rights-of-way construction, operation, and maintenance on reservation lands.

1. FIRE ARMS - A procedure would be implemented to prevent company employees, including subcontractors, from carrying fire arms or other weapons that may be used to kill game animals on reservation land.

2. OFF ROAD TRAFFIC - A procedure would be implemented to confine company employees, including subcontractors, to established roads and authorized sites. The purpose for this would be to prevent soil erosion and the harassment of game or livestock due to off-road traffic such as snowmobiles, motorcyles, 4-wheel drive vehicles, etc.

3. FIREWOOD - A procedure would be implemented to prevent employees, including subcontractors and other unauthorized people, from gathering firewood. It is the policy of the Ute Indian Tribe and the BIA to require wood permits from the Forestry Section of BIA for both Indians and non-Indians harvesting wood from the Uintah and Ouray Indian Reservation.

4. RESTORATION - A procedure would be carried out to restore abandoned roads, or other disturbed areas to or near their original condition after completion of construction. This procedure would include: (a) stockpiling topsoil; (b) establishing original ground contour; (c) re-establishing irrigation systems where applicable; (d) re-distributing topsoil to the ground surface on disturbed areas; (e) on irrigated fields reestablishing soil conditions in such a way as to ensure cultivation and harvesting of crops; (f) a procedure to ensure revegetation of the disturbed areas to the specifications of the Ute Indian Tribe or the BIA at the time of completion of construction.

5. SIGNS - All roads constructed by the applicants on the Uintah and Ouray Indian Reservation would have appropriate signs. Signs would be neat and of sound construction . They would state: (a) the land is owned by the Ute Indian Tribe; (b) the name of the applicant; (c) prohibition of firearms to all non-Ute Tribal members; (d) permits are required from the BIA; and (e) only authorized personnel permitted.

6. RIGHTS-OF-WAY - The BIA and the Ute Indian Tribe would make rights-of-way available without cost to oil shale companies when both mineral rights and surface rights are owned by the Ute Indian Tribe when the right-of-way is for direct Tribal development. It is the policy that the right-of-way be approved and a charge be assessed for damages prior to the time the oil shale company begins any construction activities; and when the surface is owned by another entity and the mineral rights are owned by the Ute Indian Tribe, rights-of-way must be cleared with the other entity.

7. PERMIT FOR WATER OR EARTH FILL - If water or fill materials are needed in constructing roads, or other authorized uses, proper permits would be needed. Included in the plan would be: (a) the approximate amount of water or material needed; (b) who owns the rights to the water or materials which are planned to be used; (c) the location where water and materials would be obtained; and (d) the approximate time period in which water or materials would be used.

8. WEEDS - A plan would be developed and carried out for controlling noxious weeds along rights-of-way for roads, pipelines, or other applicable facilities. (A list of noxious weeds can be obtained from the appropriate county.)

9. LITTER - A plan would be developed and carried out to keep the applicable sites free from litter and groomed in a neat and professional condition.

10. BENCH MARKS - A bench mark would be established near each authorized use in a location where it would not be destroyed. The bench mark would be set in concrete with a brass cap. The brass cap would show the use number and elevation to the nearest one-tenth of a foot. The engineering drawing showing the cuts/fills for the use would be required to show elevations in relation to the bench marks.

CORPS OF ENGINEERS

The Corps of Engineers has prescribed management practices that would be followed to the maximum extent practical, for discharges covered by the Nationwide Permit (items 1 through 8 below). Additionally, certain conditions (33 CFR 323.4-3(b)) must be met under the Nationwide Permit authority (items 9 through 17 below). For further detail, please refer to the COE Permit Program, "A Guide for Applicants," November 1, 1977.

1. Discharges of dredged or fill material into United States water would be avoided or minimized through the use of other practical alternatives.

2. Discharges in spawning areas during spawning seasons would be avoided.

3. Discharges would not be allowed to restrict or impede the movement of aquatic species indigenous to the waters, impede the passage of normal or expected high flows, or cause the relocation of the waters (unless the primary purpose of the fill is to impound waters).

4. If the discharge creates an impoundment water, adverse impacts on the aquatic system caused by the accelerated passage of water and/or the restriction of its flow would have to be minimized.

5. Discharges in wetland areas would be avoided.

6. Heavy equipment working in wetlands would be placed on mats.

7. Discharges into breeding and nesting areas for migratory waterfowl would be avoided.

8. All temporary fills would be removed in their entirety.

9. There cannot be any change in preconstruction bottom contours. (Excess material would be removed to an upland disposal area.)

10. The discharge cannot occur in the proximity of a public water supply intake.

11. The discharge cannot occur in areas of concentrated shellfish production.

12. The discharge cannot destroy a threatened or endangered species as identified under the Endangered Species Act or endanger the critical habitat of such species.

13. The discharge cannot disrupt the movement of those species of aquatic life indigenous to the waterbody.

14. The discharge would consist of suitable material free from toxic pollutants in other than trace quantities.

15. The fill created by a discharge would be properly maintained to prevent erosion and other nonpoint sources of pollution.

16. The discharge would not occur in a component of the National Wild and Scenic River System or in a component of a State Wild and Scenic River System.

17. No access roads, fills, dikes, or other structures would be constructed below the ordinary high water level of the streams under the Nationwide Permit. These structures would require separate "Section 404" permits.

ENVIRONMENTAL PROTECTION AGENCY

Spent shale is a mine process waste and, as such, is exempt from regulation under the Resource Conservation and Recovery Act (RCRA), pending the outcome of an EPA study, which will result in agency recommendations to Congress in October of 1983. It is not possible to determine what those recommendations would be or precisely how spent shale would be dealt with by EPA in the future. At present EPA only can recommend that industry approach this problem prudently and undertake a monitoring and mitigation program which allows maximum reasonable protection for the environment.

A spent shale monitoring/mitigation plan would need to contain several basic elements including; surface runoff control including either a pile underdrain or over-the-top drainage with erosion control, retention dams (for surface runoff), inplace soil moisture monitoring either by cup lysimeters, moisture cells and/or dry wells for continuous neutron logging and deep ground water monitoring wells of all nearby aquifers including various depth monitoring by either packers or nested wells.

Another potential problem with spent and new shale concerns auto-oxidation. Oxidation of raw and spent shale would raise pile temperatures and could threaten a fire. The likelihood for auto-oxidation depends upon several factors; the amount and type of carbon in the shale, the size of the spent shale, the temperature at which the spent shale is laid down and the air flow through the pile. EPA would recommend the following procedures to avoid excessive auto-oxidation:

1. Spent shale be allowed to reach ambient temperature before it is laid down and compacted.

2. Raw (especially fines) and spent shale not be mixed.

3. The entire spent shale pile be compacted to the maximum extent (with optimum moisture) to eliminate air.

4. No carbonacious material such as trees or shrubs (or material containing sulfur) be mixed with the spent shale.

5. An impermeable cap be placed over the spent shale pile to prevent moisture and air from entering.

6. Temperature monitors (thermocouples) be installed in the shale pile.

The EPA hazardous waste regulations are found at 40 CFR 260-265 and recommends that these regulations be consulted by the companies for minimum monitoring requirements. 40 CFR Part 265.91 describes the requirements for a ground

water monitoring system: As recommended by EPA, a ground water monitoring system would be capable of yielding ground water samples for analysis and consist of:

1. Monitoring wells (at least one) installed hydraulically upgradient (i.e., in the direction of increasing static head) from the limit of the waste management area. Their number, locations, and depths would be sufficient to yield ground water samples that are:

   i) Representative of background ground water quality in the uppermost aquifer near the facility; and

   ii) Not affected by the facility; and

2. Monitoring wells (at least three) installed hydraulically downgradient (i.e., in the direction of decreasing static head) at the limit of the waste management area. Their number, locations, and depths would be to ensure that they immediately detect any statistically significant amounts of hazardous waste or hazardous waste constituents that migrate from the waste management area to the uppermost aquifer."

In order to review this plan at a minimum the following site-specific information would need to be submitted:

1. The uppermost aquifer would be identified;

2. The hydraulic properties of formations would be determined (horizontal and vertical hydraulic conductivities);

3. Data on seasonal fluctuations in the ground water surface elevation would be given;

4. Hydraulic gradients would be identified;

5. Horizontal velocity of ground water would be determined; and

6. Detailed information on well installation would be available.

STATE OF UTAH

1. Each applicant is required by Utah Code Ann. Section 63-51-10 (Supp. 1981) to submit a financial impact statement and plan to alleviate socioeconomic impacts. Approval of each applicant's plan would be required before issuance of any state permits required to start construction.

UNIVERSITY OF UTAH

In order to avoid conflicts with the University of Utah Master Plan for facility planning and construction, the University would stipulate the following construction and right-of-way measurements for Tosco's Salt Lake City Alternative Product Pipeline:

a. Applicant would stay within existing Chevron Oil and Mountain Fuel gas pipeline rights-of-way from Red Butte Creek to Dry Creek Canyon drainage.

b. Applicant would stay within or east of the existing Chevron Oil and Mountain Fuel gas pipeline rights-of-way from the vicinity of Emigration Canyon to Red Butte Creek.

c. Applicant would coordinate actual pipeline location with the future location of Salt Lake City's 11th Avenue road prism (i.e. place pipeline under proposed road surface). This future road location is proposed to parallel or occupy the existing pipeline rights-of-way across University land.

NOTICE OF INTENTION TO COMMENCE MINING OPERATIONS APPROVAL
(Noncoal minerals excluding sand and gravel)

Introduction

The Utah Division of Oil, Gas, and Mining (UDGOM), within the Department of Natural Resources and Energy, has responsibility for issuance of permits or approval letters for intention to commence mining operations for noncoal minerals excluding sand and gravel operations, under the authority of the Utah Mined Land Reclamation Act, 1975. The purpose of this permit is to ensure protection of the environment prior, during, and following mining activities.

Operations Requirements

1. Mine development and reclamation must proceed in accorance with the approved plan.

2. An annual report (Form MR-3) must be filed every year.

RIGHT OF WAY/RIGHT OF ENTRY PERMIT

Introduction

The Utah Division of State Lands and Forestry (UDSLF), within the Department of Natural Resources and Energy, has responsibility for issuance of Right-of-Way/Right-of-Entry permits, under the authority of Utah Code Annotated, 1953, Title 65. The purpose of this permit is to protect the environment and prevent illegal entry to state lands.

Operations Requirements

1. Following approval, permittee must fully comply with all stipulations.

2. Federal specifications shall apply to the state lands where federal lands are also involved and a federal permit for a right-of-way has been granted.

APPROVAL OF AIR POLLUTION SOURCES

Introduction

The Utah Division of Environmental Health (UDEH), Bureau of Air Quality, within the Department of Health, has responsibility for approval of air pollution sources, under the authority of the Utah Air Conservation Act. The purpose of this permit is to prevent air pollution by any air pollution source except comfort heating.

Operations Requirements

1. No operating permit is required.

2. Periodic inspection must be completed to ensure compliance with permit requirements.

3. Periodic source testing at the sources expense.

PLAN APPROVAL FOR HAZARDOUS WASTE MANAGEMENT, TREATMENT, STORAGE AND/OR DISPOSAL FACILITY

Introduction

The Utah Division of Environmental Health (UDEH), Bureau of Hazardous Wastes and Radiation, within the Department of Health, has responsibility for approval of plans for hazardous waste management, treatment, storage and/or disposal facilities, under the authority of the Utah Solid and Hazardous Waste Act. The purpose of the permit is to prevent faulty construction of these facilities which may constitute hazardous conditions.

Operations Requirements

1. Following approval, the owner or operator of a facility complies with the conditions of the plan approval and the requirements of the Utah Hazardous Waste Management Regulations.

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